

A MANUAL
ON
SCHOOL-HOUSES AND COTTAGES
FOR
THE PEOPLE OF THE SOUTH.











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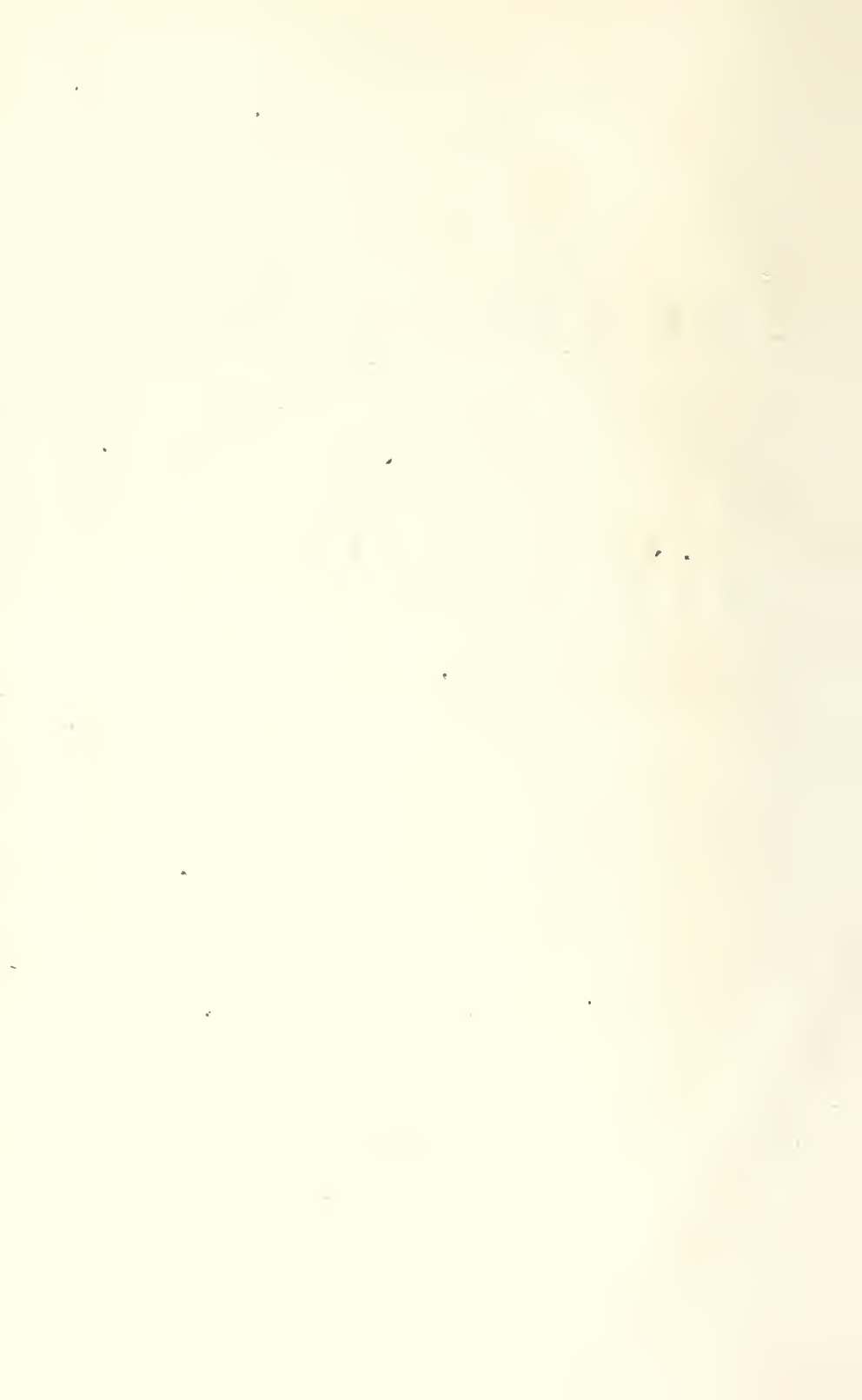
PREPARED BY

C. THURSTON CHASE,

SUPERINTENDENT OF EDUCATION, FLORIDA.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1868.



WASHINGTON, D. C., *November 28, 1867.*

DEAR GENERAL: I have the honor to hand you herewith the manual, prepared at your request, on School-houses and Cottages adapted to the wants of plain people in the South.

Several of the designs were originally prepared for schools in operation or organizing, others have been added, with such modifications as to make them of general acceptance. Those for the simplest structures comprise the substantial advantages of much more costly buildings. The directions accompanying are sufficient to enable the ordinary mechanic to erect them in an economical and approved manner. Outline plans for Union or Graded, High, and Normal Schools are presented. Bills of material and labor are given, which will aid in estimating the expense before the work is commenced. The defects of poor buildings and bad furniture, the evils of ill ventilation, imperfect heating and lighting are pointed out that they may be avoided, and the means by which good furniture, pure air, an equable temperature, and a mild light may be secured are stated. Hints are added on the selection of sites, improving the grounds, and other pertinent subjects.

It is proper to state that the small appropriation for engraving was exhausted before all the designs for school buildings were completed. Those for cottages were generously furnished as accredited. The space allowed for this portion of the work is relatively small, but the designs are good, and, if followed, will aid in overcoming those evils to which you referred in remarking that "no people can advance far in civilization where it is the practice for all the members of a family to live in one room—there to cook, eat, sleep, receive company, and die."

The work is plain, concise, and explicit. No general discussions of principles are introduced. It has been condensed and made practical that it may be the more useful. Trusting that it will meet the object for which you designed it, and do good,

I have the honor, general, to be your friend and servant,

C. THURSTON CHASE,

Superintendent of Education, Florida.

O. O. HOWARD,

Major General, Commissioner.

This book was in the possession of Mrs John A. Rockwell who herself and her husband Dr John A. Rockwell of Norwich Conn. were doing work for the Freedmen in Georgia after the Civil War under the Freedmen's Bureau.

The attached introductory note by Gen O.O. Howard and Rev J.N. Alford is interesting because they were the directors of the Freedmen's Bureau.

Rev J.N. Alford was also associated with Gen Howard and John A. Cole in founding Howard University in Washington.

Rev Mr. Alford and Mr J.A. Cole were the grand father and father respectively of Edward S. Cole who married Mary W. Rockwell daughter of Dr John A. Rockwell in 1901

INTRODUCTORY NOTE.

WAR DEPARTMENT,
BUREAU OF REFUGEES, FREEDMEN, AND ABANDONED LANDS,
Washington, January 28, 1868.

The following work is a little more extensive than I had intended. Its object is to furnish to freedmen who are constructing school-houses, cottages, and other buildings, simple models, at as cheap a rate as possible, and with sufficient detail to enable any ordinary mechanic to do the work. The officers and agents of the bureau will give to this pamphlet as wide a circulation as possible, calling to it the special attention of all who may be interested in elevating the taste of the people. It is just as easy and as cheap to construct a neat building as it is to put up an awkward and ungainly structure. I commend this work to the careful perusal of all teachers and patrons of schools, pastors of churches, and others who may have connection with public instruction amongst the colored people of the southern States.

O. O. HOWARD,
Major General, Commissioner.

OFFICE GENERAL SUPERINTENDENT OF SCHOOLS,

February 19, 1868.

I heartily commend this manual to all educational societies, school boards, superintendents, and teachers, who contemplate the erection of school buildings for refugees and freedmen. It will give them, substantially, all the facts they need on the subject.

J. W. ALVORD,

Gen'l Supt. Schools, Bureau of Refugees and Freedmen.

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THE COMMON SCHOOL.

1. The Common School is the poor man's best friend. Ignorance is his ruin, hemming him in on every side to a narrow and ignoble sphere. The school spans the gorge and makes its passage easy. The parent, indeed, may never be able to cross it, but his children can pass over from their abodes of poverty and ignorance and attain the prizes of wealth, usefulness, honor, and power among the first and the best.

The State which is well supplied with good teachers is sure to be well governed. There, property is safe and the person is secure. Schools are our best "peace establishment." In them Liberty intrenches herself. In war time they are the pledges of national strength and endurance. They are the handmaids of Virtue. They prepare the way for Christianity to go down among the vicious and depraved and draw them out of their misery and crimes to higher planes, where the practice of all things noble, pure, and true are possible.

Washington foresaw that "the perpetuity of our republican institutions depends upon the intelligence and virtue of the people." With that view his parting admonition counselled us to "promote, as an object of primary importance, institutions for the general diffusion of knowledge;" for "in proportion as the structure of a government gives force to public opinion, it is essential that public opinion should be enlightened."

Do not the events of our history point to universal education as the means on which all patriots may unite to make the nation a unit in sentiment, spirit, and power?

DEFECTS IN SCHOOL BUILDINGS.

2. According to the reports of Superintendents of Public Instruction in the different States, millions of dollars have been unwisely expended in the construction of school-houses. The cause assigned was a want of knowledge as to what a good edifice for this purpose should be, and to the absence of correct models to copy after.

The earlier school-houses were exceedingly rude and unsuitable. When private residences and other public buildings were improved, they still were neglected. For a long time the people seemed too much absorbed in subduing forests, building cities, and founding States to give educational interests their needed attention. For years after public school systems had been established the observing traveller could mark the district school-houses by their desolate, lonely, uncared-for aspect. They were too frequently located on some barren and treeless hill-side, where the hot suns of summer pelted down upon them, and the cold winds of winter had unbroken sweep; or on a narrow strip of land at the junction of highways, where the dust was sure to blow into the house from one or the other

road; or by canals and railroads, in the neighborhood of factories, or the busiest portions of villages, where study would be interrupted and the persons and morals of the children endangered. Broken windows, swinging weather-boards, leaky roofs were noticeable from without. Inside were filthy floors, smoked ceilings and walls defaced with obscene images. The furniture was of the most primitive kind and constructed with little or no reference to the comfort of those who were to use it. Appliances promotive of order and cleanliness were neglected. Hats and clothing were thrown on the floor or tossed over the benches. If there was a privy, it was a den of loathsomeness. Altogether, the common school seemed to be a place which had few attractions, but much that was offensive and repulsive.

3. In the rural districts of the South many school-houses are as yet but little better than log huts in the clearing, or deserted negro quarters in the old field. Gin houses, outbuildings, workshops, hospital barracks, abandoned town halls, and churches are very extensively used for "temples of knowledge." They are generally without lathing and plastering, destitute of suitable warming fixtures, and devoid of well regulated ventilation. Some have too much light; others no windows at all. The openings for windows may have board shutters, on closing which to keep out storms, the school is driven into the street. Very few have good desks. The benches are commonly without backs, and often so high that the children, when writing, lay their books upon them, while they kneel upon the floor. It is needless to mention the absence of books, blackboards, apparatus, and outbuildings. Some school-houses are located in marshy places, half surrounded by water, or in districts notoriously subject to the visitation of epidemics and fertile in miasma which causes chills and fever. In buildings of recent construction improvements have been introduced, but there is still a want of full and practical directions.

4. When public attention was first called to the importance of this matter, twenty-five years ago, by Mann, Barnard, Page, and others, resort was had to publications containing the needed information. Every school district in several of the States was supplied with a copy of such works as Barnard's *School Architecture* and *Pennsylvania Common Schools*. They were extensively circulated in other States. The effect produced by the dissemination of this information among the people was all that could have been desired. The uncouth devices of the past were ignored; new buildings were erected, combining all the merits which skill and liberality could provide. The locations were more fitly chosen, shade trees were planted, and suitable outbuildings were erected. Better teachers were employed and higher salaries paid. When the school-houses were improved the best talent of the communities was enlisted in the administration of educational affairs. Union or graded schools were established in villages and cities and in thickly populated rural districts. Experience added to knowledge. Thorough and complete systems of public instruction have been entered upon, and the standard of excellence steadily advanced, until the free schools have generally superseded those conducted under private auspices.

Notwithstanding the rapid progress of our country in material greatness, the improvement of our common schools has reached that high degree of excellence and contributed so largely to the promotion of the general good that we now point to them with an honest pride as the chiefest jewels we possess. There the child of the humblest laborer is privileged alike with the son of the most favored and wealthy citizen. They strive in honorable rivalry in youth, and enter the lists at maturity side by side. Through the blessings of the common school the State is honored and strengthened by the best talents of all its citizens.

Is not the course plain for those States where the common school systems have not yet received legal sanction? May they not, by taking counsel of the experience elsewhere attained, speedily gain rank for their institutions of learning among the first in the land?

THE SITE.—WHAT IT SHOULD COMBINE.

5. The officers, whether of a regularly organized school district or its near equivalent, a school society, will have the selecting of the location for the school building. It is their duty to provide for the largest convenience of the children who are to attend. The points to be regarded are that it shall be central yet retired, healthful, pleasant, and spacious. A few reasons may be added. It should be—

CENTRAL, so that the greatest number may be accommodated. This need not necessarily be at the geographical centre, but at the point most accessible for all by the roads and paths leading to it.

RETIRED from the stir of business, the dust and confusion of thronged roads or streets, away from the screaming of engine whistles and the roaring of railway trains. This precaution is needful for the quiet of study hours and the safety of the children out of school.

HEALTHFUL, that personal vigor and beauty may be promoted and the capacity for improvement quickened. The neighborhood of marshes and sluggish streams is to be avoided. Also, proximity to stables, slaughter-houses, gas-works, and all manufacturing establishments from which offensive odors are emitted.

PLEASANT, embracing, if possible, the range of a fine landscape view, with farms and cottages near at hand; villages, rivers, lakes, and mountains more remote.

SPACIOUS, giving an abundance of room for a well, outbuildings, play-grounds, separate back yards for the boys and girls; and in front, room for shade and ornamental trees, shrubbery and flowers.

These accommodations will require at least one acre of ground. In locating the building it will be found advantageous to place it a little in front of the centre of the lot yet not directly on the street, nor too near the highway.

The selection of a good site is of such high import that in several States laws have been enacted clothing proper civil officers with power to determine on the location and appraise its value after ordinary negotiations have failed.

THE WANTS OF THE SCHOOL-HOUSE.

6. The building should be fitted for the school on the same principle that a dwelling is made for the family, a storehouse for its merchandise, or a church for devotional exercises. Buildings erected for other purposes are seldom of the right size or form for schools. The health and comfort of the children while at school are not to be disregarded. All their future will be affected by the impressions they receive and the habits they contract at school. They will reach maturity with more or less vigor of physical constitution, and make better or worse citizens according to the influences there exerted upon them.

Nor are the wants of the teachers to be overlooked. There is no position more arduous, none requiring greater tact and skill, and certainly none more honorable and useful. Every aid should be extended, and every appliance provided which will heighten the effect of judicious teaching and at the same time diminish, as far as may be, the arduous labors and petty annoyances incident to the work. Not only is an airy and commodious room required, but one that shall be suited to the size of the school. A large open hall for a small school is cheerless as a barn, while a small one, overcrowded, is always uncomfortable and becomes infectious of disease. Good school-houses attract good teachers; poor ones repel them and bring education into disrepute.

The essential requisites of a school-house are briefly these:

1. A desk and seat for each pupil.
2. Aisles.
3. A teacher's platform.

4. A teacher's room.
5. Separate ante-rooms for the boys and girls.
6. Arrangements for warming, ventilating, and lighting.

Extensive rows of backless benches have long since been discarded. As soon as a child begins to write on a slate he needs a desk to lay the slate upon. If allowed or required to rest the slate or book upon his knee a habit of stooping is acquired which leads to bodily deformity and organic disease. There are two styles of desks in use—the single and the double.

7. **SINGLE DESKS.**—It is better for each pupil to be seated at a desk by himself. The younger and less accustomed to discipline the greater is this want. The size of a single desk with seat is two feet in front by two and a half in rear. Although it occupies but nine square feet on the floor, yet, with the space occupied for aisles, the platform, &c., each desk requires an average floor surface of twenty square feet. Rooms intended exclusively for small children may be made smaller on the ground, but should not be less in height of ceiling. Indeed, the height of the room should be greater, on account of the greater activity of the lungs of children in consuming the air.

The method of arranging them and the aisles may be seen in Fig. 2. Each pupil is separated from every other one. It leaves him less exposed to temptations to disorder, and relieves the teacher of the severest part of that exacting care which exhausts the strength and wastes the nervous energies of the stoutest constitutions.

The objections to single desks are wholly on the score of expense. Their first cost is greater. The school-room, to accommodate a given number of pupils at single desks, must be about one-fifth larger than for double desks. This is shown by reference to Figures 2 and 3.

8. **DOUBLE DESKS** vary in length from three and a half to four feet. In width they correspond to single desks. A desk and seat for two adults would occupy just twice that required in a single desk; but there are fewer aisles in a school-room seated in this way, so that the average space on the floor is less, varying from fifteen to twenty feet according to the width of aisles. Figure 3 shows the arrangement of double desks in a room. The construction of desks is discussed under § 72.

9. **AISLES** are primarily for the convenience of the pupils in going to and from their seats. The outside aisles are the principal passage ways; they are also used for classes to stand in during recitations and exercises at the blackboards. The usual width of the inside aisles is, between single desks, eighteen inches; double desks, twenty-four inches; the outside aisles, three and a half feet. In the plans given the front and rear aisles are set down at three feet, but there will be some gain in seating from the fact that the smaller desks take up less room than has been allowed for them. This will gain enough to make both the end aisles three and a half feet wide, or the one next the platform four feet.

SCALE OF WIDTHS OF AISLES.

	Inside.	Front end.	Back end.	Side.
For single desks . . .	16 to 20 inches.	3 to 5 feet.	2½ to 3 feet.	3 to 4 feet.
For double desks . . .	22 to 26 inches.	3 to 5 feet.	2½ to 3½ feet.	3 to 4 feet.

In large rooms, for sixty or more pupils, the centre aisle is sometimes made a foot wider than the other inside ones. The side aisles of chapels and assembly halls should be about three feet wide; the centre aisle four feet. The position of the aisles may properly have an influence in determining the position of the doors.

10. **THE ENTRANCES** to a school-room should be facing the school and at the side of the teacher's platform. To an assembly hall, chapel, &c., they should

be at the back or opposite end, so that persons coming in would not face the audience.

11. THE PLATFORM.—A liberal provision for the teacher's wants shows an appreciation which can be manifested in no other way so acceptably. Although the teacher is not confined to any particular part of the room, yet custom and convenience have indicated a situation in front of the school, from which the attention of every pupil may be instantly commanded, the signals of order announced, and general and special exercises conducted. A platform about five feet by six, or six feet square, with a table on the front, has been generally adopted. The doors through which the children find entrance and egress are situated at either side of the platform. This enables the teacher to keep them completely in order at the times when disorder is most likely to arise. It is customary to raise the platform to the height of one or two steps—say six to twelve inches. In large rooms the size of the platform is increased. In assembly halls it may be ten feet wide by eighteen long, elevated three feet above the floor. This will afford room for the seating of guests on public occasions, and admit of arrangements for musical entertainments, exhibitions, and the like.

Of the smaller platforms it may be remarked that their width must be sufficient for a desk or table in front of the teacher, two feet or two and a half wide, for the chair which the teacher occupies, and space behind the chair to move it back on rising.

12. A TEACHER'S ROOM is much needed for the safe keeping of maps, charts, books, &c., as a place for retirement and for consultation with parents or trustees who may call on business connected with the school. Here, too, the teacher may adjust the minor difficulties in a quiet way, by kindly words of admonition, which go further in correcting the errors of hasty youth than sternness and severity. Its size may be from six or eight to ten or fifteen feet square. In the larger schools it should be about fifteen by twenty feet. It may then be used for a recitation room. (See ¶ 78.)

13. ANTE-ROOMS.—To prevent the slovenly and wasteful practice of throwing the laid-off clothing on the floor, or across the benches and desk, a room should be provided between the school-room door and the outer entrance to the building—one for the boys, another for the girls—in which they may leave whatever does not pertain to the school exercises. When there is but one entrance and, at the announcement of school, all the children rush headlong for this door, confusion and discord ensue. That may be prevented by having separate entries. They should be large enough for shelves and hooks for the reception of hats, cloaks and "dinner things." They are to be divided and the divisions numbered corresponding to the numbers of the pupils' desks.

14. HALL WARDROBES may be provided in large buildings where separate ante-rooms have not been arranged, (¶ 70.) The same plan of numbering is then to be used as above, and the articles to be handed out as the pupils leave the room. The wardrobes are locked and the teacher keeps the key at other times.

AIR.

15. The condition of the atmosphere we breathe has a much greater influence upon the health of the body and the strength, vigor, and activity of the brain than is commonly understood. The external air,* as it comes to us from the forests, the field, the mountains, and the ocean, is, as a general rule, in the highest degree promotive of health. When noxious vapors are infused into it they are neutralized by frosts, or being borne on the winds are absorbed by large bodies of water, and by the countless leaves of living plants. Animals, by breathing,

* The atmosphere, according to Brande, contains, by weight: nitrogen, 75.55 parts: oxygen, 23.32; aqueous vapors, 1.03; carbonic acid gas, .10.

consume the oxygen and exhale carbonic acid gas. Plants, in turn, absorb the carbonic acid and exhale oxygen.

16. Any material change in the component parts of the atmosphere produces very remarkable consequences. Thus, if its oxygen be increased, a flame burns more intensely, animal life is stimulated and shortened by over-action. If diminished, a flame burns more dimly and at length is extinguished; the individual breathing it experiences a sense of languor and weariness; a considerable reduction eventuates in death. Let the trace of carbonic acid be increased to one per cent., in consequence the brilliancy of a flame is diminished; a stupor comes over the individual inhaling it and a sensation is felt in the brain as though a band were drawn tightly around the head. At four per cent., it extinguishes combustion and endangers life. At ten or twelve per cent., it causes speedy death.

17. It has been ascertained by experiment that six candles weighing a pound consume, in burning, all the oxygen from twenty cubic feet of air per hour. A large kerosine burner produces a like effect on twenty-five cubic feet of air in the same time. A cubic foot of coal gas consumes, in burning, twice that amount of oxygen. A fire for heating a room produces similar results, and on a larger scale in proportion to the flame.

A man of medium stature, the capacity of whose lungs is about two hundred cubic inches, exhausts all the oxygen from twenty cubic inches of air at each respiration, and imparts four and a half per cent. of carbonic acid gas to the expired breath. The blood at once absorbs the oxygen and is vitalized by it, while it rejects the effete or used-up matter which it has gathered in its circulation through the system, and returns again through the arteries to infuse new life to every part and to receive anew the waste material which is no longer needed, but which the system cannot retain without experiencing serious organic derangement. When no provision is made for the escape of the impure air from a room it is resorbed by the lungs of those in it and contaminates the blood with which it comes in close contact.

The weight of the exhalations from the lungs and pores of the skin, by a school of forty-eight pupils, during the six school hours of a day is set down at two pounds, and that of the carbonic acid gas brought into the air by the returned breath amounts to sixteen pounds per hour. Filthy floors and untidy clothes greatly increase these evils. We now pass to consider briefly the effect of these changes upon the animal economy.

18. It is well known that the activity of any particular member of the body depends upon the amount of oxygen which is communicated to it. The blacksmith's arm, by increased labor, claims and receives an increased supply of blood and of oxygen from it. But let the needed flow be diminished, the arm shrivels, its muscular power is lost. A total suppression paralyzes it altogether. The brain, weighing only one-sixteenth of the whole body, consumes, by its ceaseless activity, one-sixth of all the blood thrown out by the heart. A suppression of the arterial current to the brain causes stupor and dizziness, followed by fainting and finally death.

A simple experiment will illustrate the fact. Place any small animal, as a mouse, under a glass jar from which the air is excluded. Soon its breathing becomes perceptibly labored, growing more and more difficult, until he drops down in a stupor and presently dies. If a candle were inserted instead of the mouse the flame would, in a short time, burn dimly and continue diminishing in brilliancy until it is extinguished. The air in the jar is now in such condition as to produce death to animal life immediately or extinguish flame at once. But if, on the other hand, the jar had been filled with pure oxygen, the results in both cases would have been directly the reverse.

The purity of the atmosphere breathed by persons engaged in outdoor employment is one chief cause of their enjoying better health and greater cheerfulness of spirits than those confined to sedentary employments. It is a common remark that puny clerks and delicate craftsmen become, as soldiers or engineers, robust, hardy men.

19. When the atmosphere is highly charged with heat it is liable to be less vitalizing than before its temperature was raised, and from two causes. First, on being heated it becomes rarer or thinner, the lungs by a given expansion inhale less oxygen than when the air was cooler and denser. Second, the healthfulness of the air is impaired by heat, unless at the same time the watery vapor which it contains is increased. Air, saturated with moisture at a temperature of thirty-two degrees, becomes insufferably parching to the lungs and skin when heated to seventy-five degrees without an addition of moisture. About three hundred per cent. more is required at the latter than the former temperature.

20. The nature of the refuse matter thrown off by the lungs and pores of the skin demands further consideration. Chemical analysis has failed to define, satisfactorily, the character of these bodily exhalations. They contain properties, so subtle as to elude detection, which are fraught with the most painful consequences to those who are exposed to their contact. Some idea of their nature may be formed by placing a sponge, saturated with water, in the ventilator of a crowded hall to receive the escaping current. The fetid air of the room imparts an offensive odor to the sponge and the water even becomes putrescent. It is a well established fact that a person afflicted with an infectious disease so charges the atmosphere of a large assembly hall with a subtle contagion that any person breathing the air may be contaminated.

What parent, teacher, or school officers, who regard the well being of the youth committed to their charge, can longer remain indifferent, on a candid consideration of the facts adduced? The report of a committee appointed by the New York city Board of Education, in commenting on the dangers to the pupils breathing an atmosphere which has been thus corrupted, says: "The rottenness of the air is communicated to the lungs, and lung diseases are generated. The enormous mortality from lung diseases, averaging a hundred and ninety deaths per week, is in a great part attributable to the foul air breathed every day by the 60,000 children in the schools. The prevalency of scarlet fever, which for the past few years has been remarkably great in the primary schools, may be attributed to the same cause in even a greater degree."

VENTILATION.

21. The remedies for these evils are simple. They lie wholly within the reach of those who have charge of the construction of the school buildings and the management of the schools. In the first place, the causes which render the air impure should be abated as far as possible. When the air becomes impure it should be driven out and pure air supplied in its place, or, more definitely—

1. The floors, walls, and furniture should be kept perfectly clean.
2. Personal cleanliness of the pupils should be enforced.
3. In constructing the building provision should be made for expelling the vitiated atmosphere as fast as it becomes impure.
4. At the same time arrangements should be made for admitting pure, fresh air from without.

This is simply driving out our enemies and entertaining our friends.

A room to be healthful should contain not less than one hundred and eighty cubic feet of atmosphere to each person in it. And this entire volume should be changed every hour.

22. This can easily be done by availing ourselves of the fact that, when the

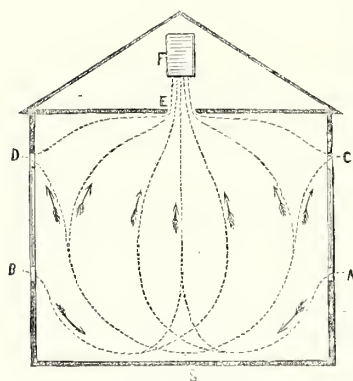


Fig. 1. Vertical section of school-house, showing air currents.

the room which lies below the level of A and B can at the same time escape; but that which is above it cannot. The colder and heavier air below buoys it up. By contact with the fresh air a portion of it becomes cooled, descends, and passes out at the openings. Now lower the upper sashes. The air in this region of the room will pass out at the openings C and D, as represented, both from below and, on account of general movement of the air, from above. The change is rapid, and the result invigorating to the inmates.

In mild, pleasant weather lowering the upper sashes will ventilate the room sufficiently. But when storms and high winds prevail it is necessary to keep the windows closed. To meet this emergency let there be an opening in the ceiling at E, two or three feet square, closed by a fan-door hung on pivots. Place a Venetian blind, with broad slats, in the gable at F; or, if you prefer it, a fan-door instead of the blind. Let both the fan-doors be controlled by cords, which come down within reach in the room, to be opened or closed at pleasure. Suppose they are open and the sashes closed. The general direction of the warmer air is represented by the lines tending towards E and F. When storms occur the windows may be opened on the opposite side of the room from the direction of the wind to admit a fresh supply of the external atmosphere.

This very simple mode of accomplishing our object has the further recommendation of being easily and cheaply constructed. It will not be sufficient to provide the one opening at E and allow the bad air to accumulate in the loft. There should not only be an opening in one, but in both gables to allow the air from below to escape, but also to convey away the air in the attic, which, in very hot weather, becomes heated to suffocation by the rays of the sun falling upon the roof.

24. WINTER VENTILATION. In cold weather our plan for ventilation must be changed. Instead of conveying away the heated air, we wish to retain it in the room as long as it is pure. Then drive it out and introduce fresh air. The fetid matter from the breath rises with it at first; on cooling, it descends. It may be said to pervade every part of the room. Let us now unite two operations, that of warming and ventilating. Prepare a stove, as described in ¶ 29. This will give us an unbounded supply of pure air warmed by the heat of the stove before it enters the room. For a room of fifty pupils we construct two ventilating tubes, each ten inches square in the clear, and place them on opposite sides of the room; or one of fifteen inches, and place it at the end opposite the doors. They extend from the floor to the peak of the roof, and there terminate in some "ejector," as Emerson's, or the American. An aperture is made in the tube near the ceiling, and another near the floor. They are readily closed with

temperature of any portion of the atmosphere is raised three or four degrees higher than that with which it is in communication, it immediately ascends. The expelled breath, being warmer and lighter, rises to the upper regions of the room, carrying with it the waste material from the lungs. It needs no argument to show that if this can be allowed to pass off, the purity of the air will be maintained much longer than if confined.

23. SUMMER VENTILATION. To show the practical working of what is termed ventilation, or the controlling of air currents, let us suppose all the openings, as shown in the figure, are closed, except those under the sashes at A and B. As the cool air comes in at these from outside it drops to the floor, as shown by the dotted lines and arrows. The warm air of

tight-fitting doors. All the joints of the tubes are air-tight. By opening the lower aperture the air escapes into the tube, and passes off. When the fire is burning briskly the pure hot air rises to the ceiling, the cooler falls to the floor, and is thus conveyed away. The dust, smoke, and all impurities may soon be exhausted from a room in this way. To cool a room suddenly open both the upper and lower ventilator. (See ¶ 70.)

25. FORCED VENTILATION may be secured at all times by placing a stand for a lamp, or in cities where gas is used, a gas-burner, in the ventilating tube. It may be situated five feet from the floor, and be accessible through a door in the side of the tube. On starting the flame an uplifting column of air will always be obtained, which can be relied upon for carrying away the foul air under all circumstances.

26. Care must always be taken that cold air, when admitted, does not fall upon the heads or backs of the occupants. It should be diffused so evenly and gently as to produce no perceptible currents. A fine screen, judiciously placed, through which the air may pass, will effect this object. Its position may be overhead, and the air permitted to "sift" into the room in that manner. But in common practice the careful attention of a teacher will regulate this matter.

WARMING.

27. An even temperature is promotive of the greatest comfort and health. In an overheated room the system becomes excited; the children grow restless, peevish, and disorderly, the teacher nervous and irritable. Relaxation will follow, exposing the system to insidious attacks of fevers, lung diseases, scrofula, &c. A cold room is scarcely less harmful. The modes of heating most commonly in vogue are the fireplace and the stove.

28. THE FIREPLACE, first used six centuries ago, still retains a strong hold in wooded regions. Although it wastes fully three-fourths of all the heat generated, yet it likewise changes the air of a room rapidly, and conveys away at the same time the impurities which may exist in it. By contracting the openings of the front and the passage at the throat of the flue it is made less wasteful of fuel.

The position of the fireplace is shown in Fig. 5. When the room is large two will be needed, one at each side. The chimney tops must be carried up higher than the peak of the roof, and be well braced that they may not blow over.

29. STOVE. A good stove will not waste more than a fourth of its heat. Of those in common use for country schools, where wood is abundant, the style known as the six plated reversible flue is regarded as most economical of fuel. Some of the newer styles of coal stoves are still better. In larger rooms two wood stoves will be needed. Their position is shown in Fig. 11.

The best arrangement for warming a room is by a stove placed in the centre, encased with a covering of zinc or galvanized sheet-iron, about a foot from the stove. Let a pipe open into this space from underneath connecting with the external air. It should be closed by a damper. There is to be a door in the casing opposite the stove door through which to attend to the fire. The top of the casing is perforated with holes for the passage of the heated air, or is supplied with a register. By the use of a stove and the appendages here described, in connection with the ventilating tube, (¶ 31,) the heated air rises to the ceiling, while the cold and somewhat impure portion is drawn from the lower part of the room. The newly heated air is the purer. After it has risen it is then dissipated throughout the mass of atmosphere around it until the whole becomes pleasant and comfortable. The position of the stove is at S. Fig. 1.

30. The proper temperature of a school-room is between sixty-five and seventy-two degrees Fahrenheit.

LIGHTING.

31. Too much light on the eye causes pain; if long continued, blindness. Too little light compels the student to bring the head too near the book, induces a habit of stooping, and produces near-sightedness. Cross-rays—those falling on the eye from an end and a side of a room—are injurious. To a disregard of these facts may be traced the early failing of that strength, clearness, and beauty of the eye for which nothing can compensate.

The mean to be secured is an even, mild, mellow light that shall not pain by its intensity nor strain the nerve by its faintness.

32. The admission of light must be regulated by the windows. They should not come nearer the floor than four feet, and should extend high up towards the ceiling. The reasons are two-fold. If they descend near to the floor the air admitted by raising a window will strike on the necks and heads of the pupils. There will be unnecessary temptation to turn the attention to what may occur outside. Again, the light which is admitted at the top of the window diffuses itself more equally through the room, and falls on the book and the eye more acceptably. Venetian blinds with movable slats are the best appliances we have for regulating the admission of light. Those placed on the outside have some advantages in defending against the heat and protecting the glass from accident, but those inside are more manageable. (See ¶ 70.) Quite a perfect adjustment may be obtained by the use of both kinds. But it will often happen that neither will be supplied. Curtains may then be made to take their place. Their color should be pleasant to the eye, as green, a mild brown or drab, straw color, or a tint of purple, but neither black, white, nor any bright color is admissible. They should be arranged to lower from the top instead of rolling up from the bottom. In that way the light will be more agreeably diffused through the room. When, for purposes of ventilation, windows are placed in front of the pupils or facing the teacher, they should be provided with thick curtains, capable of excluding all the light when necessary.

33. While on the subject of windows a hint may be offered on a ready way to lower the upper sash when it has no weights. Take a chisel and mallet and cut out a strip of the casing underneath the sash, say twelve or sixteen inches. Nail an inch strip against the casing so that it will come close to the side rail or stile of the sash. Bore a quarter-inch hole through the stile and into the strip just nailed on. One hole through the stile is sufficient; three are needed in the outside strip. With the use of an iron pin or hard wood peg the sash may be held to any required height. In default of a strip being nailed to the outside casing, holes may be bored through both the upper and lower stiles to answer the purpose about as well. For further security a button let into the opposite stile, say half way from its top, may be made to hold the upper sash in place when closed.

PLANNING THE SCHOOL HOUSE.

34. How large shall the school-house be? The answer to this question will depend chiefly upon the number of pupils to be accommodated, but in part upon the system of teaching adopted, and will always be influenced by the kind and style of furniture used.

35. **THE UNITS OF MEASURE.**—One teacher to a room and forty-eight pupils to a teacher are the full complements, that should be allowed. Where more teachers are required there must be more rooms. Two teachers cannot work advantageously together. The confusion of two classes reciting at the same time, and two persons explaining difficult questions or commanding order simultaneously, cannot fail to distract the attention of the pupils and retard their progress. The work in an ungraded school is greater than in one that is well

classified. It is better, therefore, in rural districts to calculate on giving fewer pupils to a teacher. Twenty-five are sufficient to employ all the time and energies of a first-rate instructor. Could parents make up their minds to meet the extra expense they would be better satisfied with the result. The law of compensation holds true in regard to teachers as in the market place: We must give value to get value in return.

36. It may be remarked, in passing, that when the school increases beyond the number which the teacher can attend to, the teacher's room may be used as a class-room by an assistant or one of the advanced pupils in hearing the recitations of the beginners. All the plans contemplate this as a probable necessity, and have been arranged accordingly.

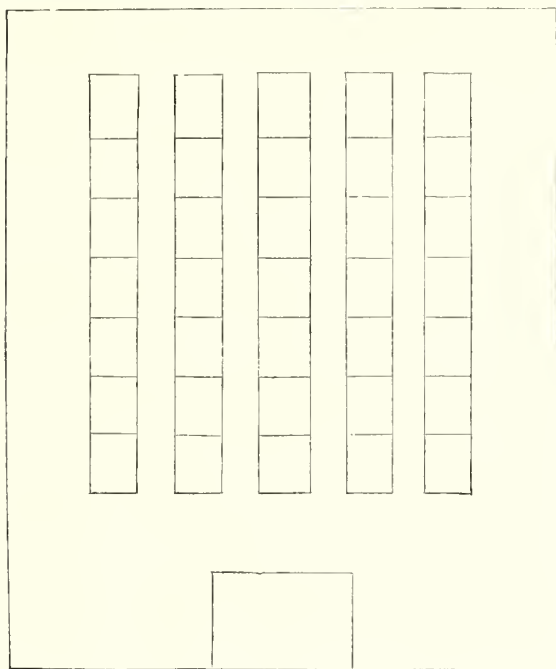


Fig. 2. School-room for thirty-five pupils at single desks.

Let us divide them into five rows of seven in a row. Set them a foot and a half apart to give passage ways. This forms a parallelogram-shaped block sixteen feet across in front and seventeen and a half deep. Add an aisle three and a half feet to each side, the total width is sixteen feet. An aisle of three feet in rear, another of three feet in front next the platform, with the width of the platform, five feet, added, will give a total length of twenty-eight and a half feet. The teacher and each pupil has an average space on the floor of nearly twenty feet. This is a very suitable form for a school room.

The divisions in the rows represent the spaces occupied by the desks and seats. Single desk 2 feet in front by $2\frac{1}{2}$ feet in the row; inside aisles $1\frac{1}{2}$ foot; side aisles $3\frac{1}{2}$ feet; end aisles 3 feet. Teacher's platform, 5 x 6 feet. Size of room, $28\frac{1}{2}$ x 23 feet.

37. Suppose the school officers on counting up find that they need to provide a house for thirty-five or forty pupils. Only a small building is required. Let us lay two plans: one, for seating each of the pupils at a desk alone; the other, two at a desk. The thirty-five pupils, if seated separately, would of course require thirty-five desks. They are to be arranged in convenient form for the observation and instruction of the teacher, as well as for their own comfort.

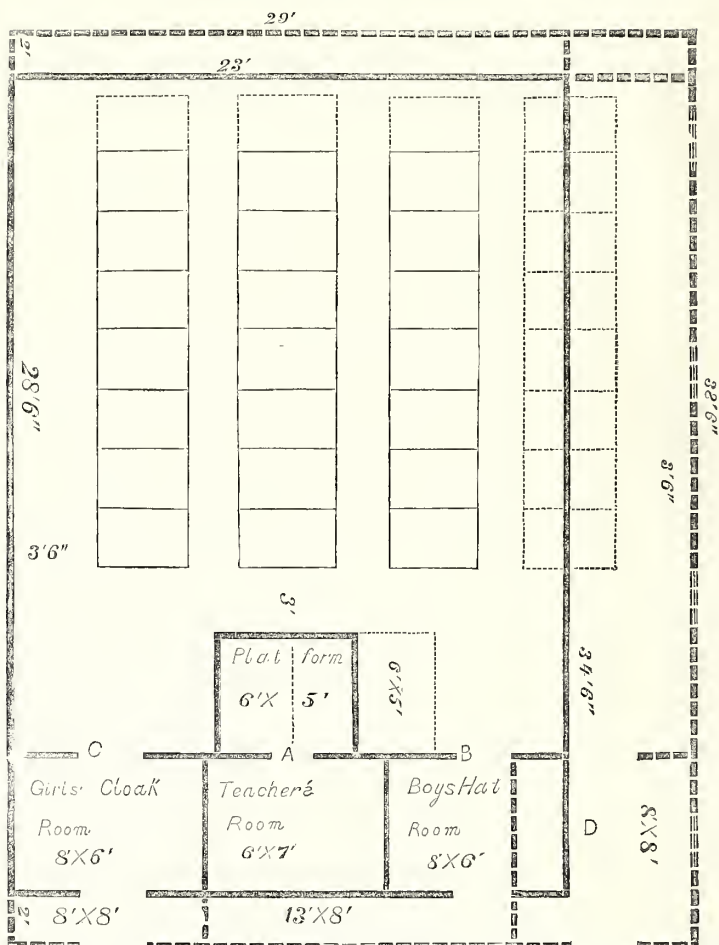


Fig. 3. A diagram showing the mode of arranging school-rooms for 42, 48, 56, and 64 pupils at double desks. Also, the size and position of the teacher's room and ante-rooms adjoining.

38. Full-sized double desks occupy a floor space equal to 4 feet in front by 2 1/2 feet in rear. The side aisles are 3 1/2 feet wide; inside aisles, 2 feet; rear aisle, 3 feet; front aisle, 3 feet; teacher's platform, 5 feet. The sizes of the teacher's room and ante-rooms are shown in the engraving.

39. PLAN OF SCHOOL-HOUSE FOR FORTY-TWO PUPILS—Forty-two pupils will require twenty-one double desks. The most convenient form in which they can be arranged is to divide them into three rows of seven in a row. These are indicated by the continuous lines. Those with dotted lines have reference to other plans. Allowing for aisles and platform as above, the size of the plan is 28 1/2 by 23 feet. Each pupil and the teacher will have an average area on the floor of fifteen square feet. The height of the ceiling should be 12 feet. This gives 180 cubic feet of air to each occupant of the room. The ante-rooms are 8 by 6 feet; teacher's room, 6 by 7 feet. Outside measurement, 36 by 24 feet.

40. Persons accustomed to living under ceilings not more than seven feet high will be likely to object to the heights here recommended. If they will not waive their objections and require the sides of the rooms to be lower, let

the ceiling extend up on the rafters to the collar-beams. It is even better, where the climate will admit, to have no ceiling to the smaller school-houses than to box the children up within such narrow spaces that their health will be continually in jeopardy from the bad air in the room. (See ventilation, ¶ 21.)

The positions of the ante-rooms in the plan are properly represented. As the pupils come in and go out they will pass near the teacher and be less liable to be disorderly than if they left the room at the opposite end.

41. PLAN OF SCHOOL-HOUSE FOR FORTY-EIGHT PUPILS.—Six additional seats are required to be added to the last plan. Throw the rear wall two feet farther back to the heavy dotted line. This, with the few inches gain which will be likely to accrue in seating, will give room for one more desk to be added to each of the three rows. The extra desks are shown by dotted lines. No other change need be made.

The size of the room is $30\frac{1}{2}$ by 23 feet. Outside measurement of plan is 38 by 24 feet. The height of ceiling should be 13 feet.

42. PLAN OF SCHOOL-HOUSE FOR FIFTY-SIX PUPILS.—To lengthen the room would make it disproportionate for its width. It is better to bring in the rear wall to its former position, making the sides $28\frac{1}{2}$ feet in length and extend on the right, as represented in the cut by the heavy dotted line, far enough to give space for another row of desks, (4 feet,) and aisle, (2 feet,) making its size $28\frac{1}{2}$ by 29 feet. Remove the teacher's platform 3 feet to the right. Extend the front wall 2 feet to give an opportunity for enlarging the ante-rooms and the teacher's room. With this number of pupils attending, the teacher will need an assistant, or the aid of an advanced pupil to hear some of the beginners in another room. The ante-rooms will be enlarged to 8 by 8 feet and the teacher's to 13 by 8 feet. This is practically enlarging the school-room. The ceiling should be $13\frac{1}{2}$ to 14 feet high.

A large sum of money may be expended on a school building of this size, yet a very moderate amount may be made to procure all the substantial advantages in a modest and comfortable structure.

43. PLAN OF SCHOOL-HOUSE FOR SIXTY-FOUR PUPILS.—Following out the same mode of enlarging as before, we remove the rear wall two feet and get room for another desk at each of the four rows, indicated in the cut by dotted lines. Each row now contains eight double desks, at which sixty-four pupils may be accommodated. The room is $30\frac{1}{2}$ by 29 feet. Outside measurement 40 by 30 feet.

With a ceiling 14 feet high, and the teacher's room regularly occupied as a class-room, the space to a pupil on the floor would be 15 feet, and the number of cubic feet of atmosphere would be 180. But when the teacher's room should not be occupied and all the desks in the room are used, the air in the room will rapidly become vitiated. To relieve it, as well as to lessen the burden of the teacher, the younger children may be dismissed, or take a recess, after their morning exercises are passed.

44. In planning buildings which demand accommodations for many pupils the elements here laid down will aid in arriving at the proper form, size, and general arrangement. It is not well to build several stories high. Two should be the limit. Extend the rooms in either direction. Carry up towers for stairways; or, better still, build piazzas from which to ascend by stairways to the upper story. To avoid many blunders, let the plans be well considered; consult an experienced teacher as well as a good architect before letting the job or beginning the work.

45. TABLE OF SCHOOL-ROOMS, showing sizes required for the different desks to seat a given number of pupils. The side aisles are $3\frac{1}{2}$ feet; inside aisles, 2 feet; rear aisles, 3 feet; front aisle and platform, 8 feet; space allowed a desk in a row, $2\frac{1}{2}$ feet.

Desk.	Length.	No. pupils.	Size of room.	No. pupils.	Size of room.	No. pupils.	Size of room.	No. pupils.	Size of room.
No. 1	4 ft. 0 in.	42	28½ by 23 ft.	48	31 by 23 ft.	56	28½ by 29 ft.	64	31 by 29 ft.
No. 2	3 ft. 10 in.	42	28½ by 22½ ft.	48	31 by 22½ ft.	56	28½ by 28½ ft.	64	31 by 28½ ft.
No. 3	3 ft. 8 in.	42	28½ by 22 ft.	48	31 by 22 ft.	56	28½ by 27½ ft.	64	31 by 27½ ft.
No. 4	3 ft. 6 in.	42	28½ by 21½ ft.	48	31 by 21½ ft.	56	28½ by 27 ft.	64	31 by 27 ft.

CONSTRUCTION OF SCHOOL-HOUSES.

46. The hints on the construction of different styles of buildings, the bills of material and labor, also the specifications attached to several of the designs, have been furnished by master-mechanics or architects skilled in their business. They are intended to aid school-officers as well as suggest to less experienced workmen those ready ways by which close observers and successful craftsmen learn to do plain work rapidly, cheaply, and well. The man who can do twice as much as another in a given time can not only make more money, but also have more leisure for improvement and recreation. Such men work with their minds as well as their hands, and thus learn those ready ways which give them their advantage over less active and thoughtless men.

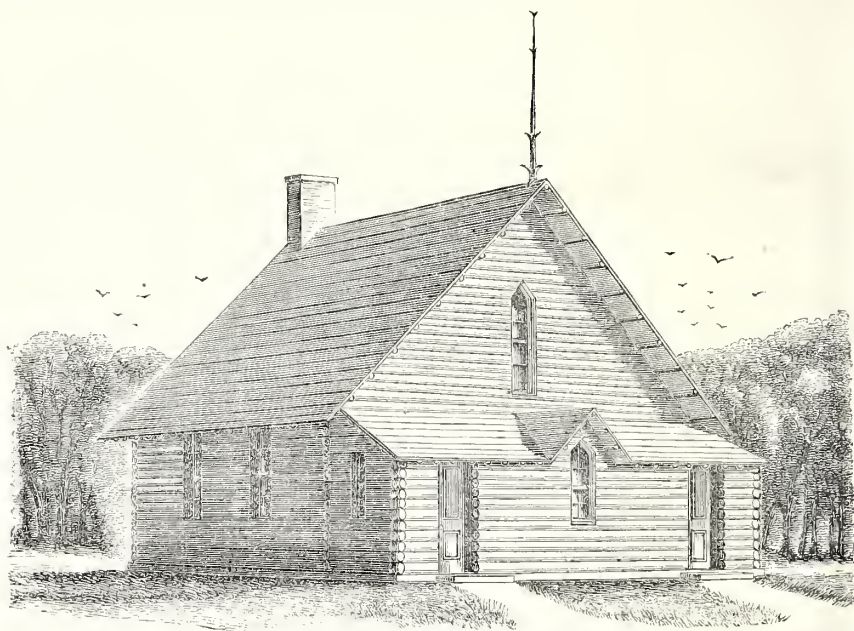


Fig. 4. Design for Log School-house.

47. The wigwam is superseded by houses built of logs before saw-mills are erected in a new country. Combining, as it does, not a few excellences, this style of building deserves more consideration than it receives. There is no good reason why a well-built log-house should not be as comfortable as any other. Logs are non-conductors of heat. The sun does not "strike through them," as through a common hollow, or any thin-walled house. The timber can, in wooded regions, be had for the asking. The chopping, hauling, and construction involve more labor than the box-frame style of building, but the "money out" is less. Where labor and timber are plenty and money scarce, let

there be more pains taken in erecting the building; then every advantage that is absolutely necessary may be gained. A good log-house will last a generation.

The main building is 34 by 30 feet, with a lean-to of eight feet, subdivided into a teacher's room and ante-rooms; pitch of roof, 17 feet; projection of eaves, 3 feet; height of ceiling, 13 feet.

48. The construction of a log-house is generally best understood by the frontiersmen who use them. The following hints may not be unacceptable to beginners:

Select timber which will last well when exposed to the weather. The logs should be 10 to 12 inches in diameter. The sills might be heavier, say 16 inches, squared, hollowed at the ends and pinned, or, better, spiked with 60-penny nails. The floor timbers are mortised with the sills and supported in centre by a bearing beam, as in ¶ 49. The ceiling, joists, and rafters are lighter, say 7 inches. After they are up the joists may be stayed to the rafters to prevent their settling. Still smaller sticks may be used for the partitions, say 4 or 5 inches in diameter.

There are several ways of making the partitions. One is to lay the logs horizontally between two standards or upright posts at each end. Another is to plough out a groove in larger sticks, squared, say two inches deep. Set up one at each end of a partition, and for door posts. Hew down the ends of the stuff for partitions so they will fit nicely into the groove. This done, put them in their places. They should be smoothly payed on each side with stiff clay, or chinked in the ordinary way. They may also be made of tongued and grooved inch and a quarter stuff, set upright, run into grooves in a head piece above and fixed by strips nailed each side at the bottom. Let the roof project far over the sides to shield them from the storms and hot sun.

The ceiling may be covered with boards, battened, and the whole inside whitewashed. It is better, however, to lath and plaster when lime, sand, and hair are obtainable. Then, with good furniture, the establishment may well challenge our pride. On such a house not over two hundred dollars in money need be expended to accommodate fifty to sixty-four pupils.

The finial (the ornament on the peak of the roof) should be made of some regularly branching sapling, the limbs trimmed to even lengths.

DESCRIPTION OF PLAN.

Scale $\frac{1}{12}$ inch to 1 foot.

- A. School-room, 32 by 28 feet.
- B. Boys' ante-room, 8 by 7 feet.
- C. Girls' ante-room, 8 by 7 feet.
- D. Teacher's ante-room, 11 by 7 feet.

Size of desks to be used, No. 3.

Side aisles, $3\frac{1}{2}$ feet.

Centre aisle, $2\frac{1}{2}$ feet.

Rear aisle, 4 feet.

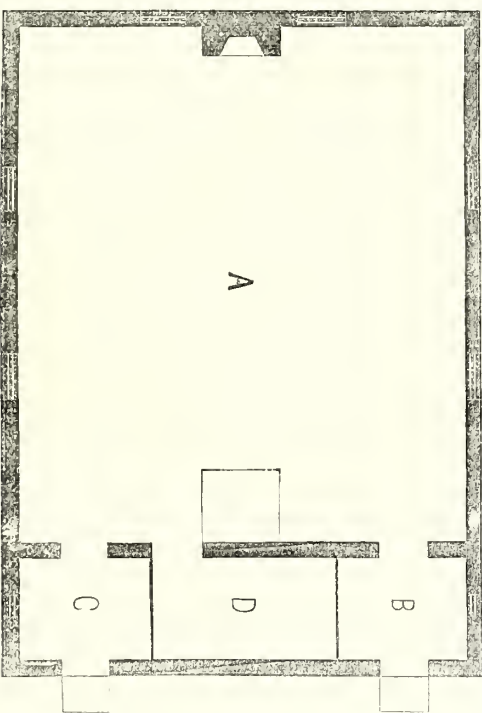


Fig. 5. Plan of Log School-house for sixty pupils. Outside measurement, 34 by 30 feet.

By using desks, size No. 3, (§ 97,) the aisles will be of good width. The first tier of seats should be set about five feet from the back end. To make room for those who come to the fire, leave out a desk from each of the two middle rows. A screen will be needed in front of the fire. Should it be preferred to have the girls and boys enter their ante-rooms directly from separate yards on either side of the building, this can be attained by changing the doors from the front to the sides and placing the windows in front. The garret over the school-room is large. It may be used to store extra seats in. There should be a trap-door in the ceiling and a ladder to ascend to the garret. On one side of the chimney a stationary Venetian blind should be placed to be used in connection with the window in the other end, to allow the air to escape that may become heated in summer or vitiated from any cause. If care be taken in the construction, and then the finishing include lathing and plastering, as well as ventilating and lighting in a proper manner, the log school-house will do well for many years.

49. THE BOX FRAME is the simplest style of building a house of sawed lumber. It has sills, floor timbers, plates, and rafters, but no posts, studding nor framed braces. Let us take the ground plan designed to accommodate thirty-five pupils with single desks or forty-two at double desks (§ 39) and erect a building over it. The outside measurement is thirty-six by twenty-four feet. This allows six inches for each outside covering. It will not take quite so much. But as we will not begin by begrudging space, from which comes comfort, convenience, and health, to those for whom we most delight to labor, the building may be framed accordingly.

We mortise the side and tenon the end sills, or *vice versa*. They are 6 by 8 inches, framed to lie edgewise, if there is not a continuous wall laid for them to rest upon. The centre sill, running lengthwise, also called a bearing-beam, stands two inches lower than the others and is well supported by frequent piers. Leave the ends of the side-sills on until the sides are up.

The floor timbers are gained down two inches at the outer ends and come flush with the sill. The ends which rest on the bearing beam are not gained at all. Spike them to the sills. When the floor is laid the building cannot spread. Care has of course been taken that the piers are level and correspond to the ground plan.

Inch and a quarter plank 8 or 10 inches wide are used for the siding. They are first cut to lengths. We commence at the corners. Take two plank; saw off one so that it will fit over the projecting end of a sill; nail them together; set up; plumb and stay. The same at the other corners. The plates having been cut the length of the side-sills, may be raised to their places, even height with the corner-boards, nailed to them and shored up in the centre. Put up scaffolding from which to nail the upper ends of the siding. Side up. Leave no openings for doors or windows. Saw them out afterwards wherever you want them.

A shorter way where there are half a dozen workmen on the job, is to make a platform of the floor timbers and roof boards; lay a side-sill in place and a plate the right distance inside to nail the siding to. Look out that the ends are even and that the first plank nailed on is at right angles with both sill and plate. They have all been cut to lengths and may now be nailed on rapidly. This done, all hands take hold, raise the side to its place, plumb and stay. Serve the other side in the same way.

A slip-mortise is preferred by some builders for the ends of the sills to the common mortise and tenon. The side-sills are cut to the right length. The mortise is made quite out to the end. The tenon on the end sill is left the whole width of the stick. They are slipped together and spiked with 60-penny nails. The spikes are far preferable to wooden pins. They are cheaper and hold better.

The beams or ceiling joists are gained down one inch and a quarter. Raise the two end ones first; then the rest. If they are to be lathed on they will be placed either twelve or sixteen inches apart from centre to centre. If not, two feet is near enough. Nail them firmly to the plates to prevent the spreading of the roof. Next put on the roof. Finish with the corner boards, base, battens, &c. Cut out for the doors and windows, and case up the openings.

The engravings explain themselves. They present a view of the position of the doors and windows, the Venetian blind in the gable for ventilation, (see ¶ 30,) the rafters and the ridge-board, to which they are nailed to keep them in place, the piers, &c. In finish it is perfectly plain. The eaves project three feet.

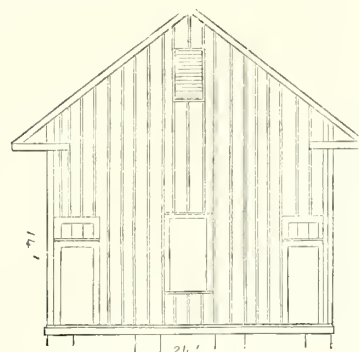


Fig. 6. End elevation.

To correspond let the corner board, base, &c., be broad and heavy. Then the building will not look mean and poverty-stricken, but seem to be devised with some degree of liberality.

The overhanging eaves, besides improving the appearance of the house, carry the water which falls on the roof quite away from the sides. They also shield them from the sun's rays, and allow the windows to be lowered from the top for ventilation on rainy days. Thus they make the building more comfortable and lasting.

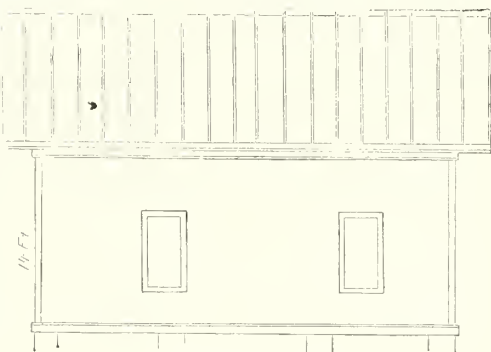


Fig. 7. Side elevation.

50. A batten to be worth anything must have its corners chamfered off, as shown in the cut. When this is done the action of the sun and weather makes it hug the siding more closely. When it is neglected the same causes curl up the edges, draw the nails, and leave the cracks exposed, which they were made to cover.

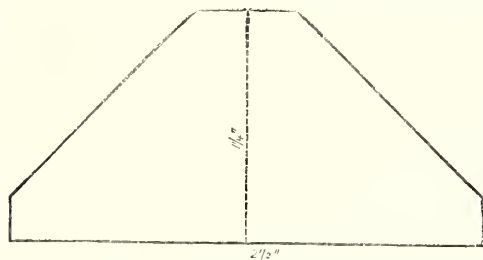


Fig. 8. Cross section of a batten. Full size.

The material for battens should be straight-ripped, heart stuff, an inch and a half thick, two and a half wide. The expert workman, who studies how to save labor, will make a box in which to place the battens one after another, and chamfer off their corners rapidly and nicely with a drawing-knife. If the under side of the batten was grooved out it would still be an improvement. It will hardly pay to do that by hand.

The stationary Venetian blind in the gable is for purposes of ventilation. (See ¶ 23.) The slats should be broad, and placed near together to prevent storms beating in. A fan-door, hung on pivots, is placed in the ceiling, to be used in regulating the escape of impure air from the room.

Bill of materials and work for a box-frame building 36 by 24 feet; ceiling, 12 feet; pitch of roof, 6 feet; projection of eaves, 3 feet.

	Feet.
Sills, 2 pieces, 6 by 8 inches, 38 feet long.....	304
Cross sills, 1 piece, 6 by 8 inches, 38 feet long.....	152
Cross sills, 2 pieces, 6 by 8 inches 25 feet long.....	200
Plates, 2 pieces, 2 by 6 inches, 36 feet long.....	72
Floor timbers, 30 pieces, 3 by 12 inches, 24 feet long.....	1, 800
Ceiling joists, 12 pieces, 2 by 8 inches, 24 feet long.....	384
Rafters, 26 pieces, 3 by 8 inches, 18 feet long.....	936
Roof boards.....	1, 400
Flooring, (surface measure,) 960 ($\frac{1}{4}$ added, 240)	1, 200
Siding, (surface measure,) 1,930 ($\frac{1}{4}$ added, 480)	2, 410
Finishing stuff for door and window frames, easings, base, battens, &c.	2, 500
Total.....	11, 360
Shingles	12, 000
Doors	5
Windows	7
Nails, in following proportions: shingle, 60 lbs.; 8-penny, 40 lbs.; 10 penny, 400 lbs.; 12-penny, 100 lbs.; 20-penny, 33 lbs.; 40- penny, 34 lbs.; 60-penny, 33 lbs. Total kegs.....	7
Brick (8 by 4 by 2 inches).....	400
Carpenter's work, days	230

51. We have now only the shell of a house. It may be used without plastering the side walls; but the ceiling should be lathed and plastered. The partitions may be of inch and a half stuff, planed, tongued and grooved, and set endwise. Or without tongues and grooves, in the rough, battened and whitewashed as all the insides of the rooms should be. Many a school is prospering in poorer quarters. In the extreme south, where private dwellings have been occupied for years without plastering and considered comfortable, this style of house will do well to commence with, especially if nicely furnished. If the house stands in an exposed position where the winds would be liable to injure it, boards may be nailed on the inside at an angle of forty-five degrees with the siding to make it perfectly staunch and secure.

The extra expense for lathing and plastering would be but trifling. The following are the additional items:

Laths, 4,650; wainseoting, two feet on front end and sides, four feet on back end and in the ante and teacher's rooms, 540 feet; lath-nails, 20 pounds; plastering, 340 yards; mason's work, including chimney, 34 days.

The materials for a balloon frame building of the above description include those already given and the following additional:

For frame, 2 by 6 inches, 1,400 feet long; partitions, 3 by 4 inches, 432 feet long; nails, 10-penny, 200 pounds; carpenter's work, 40 days.

For the method of constructing a balloon frame, reference may be had to ¶ 65.

There are other methods of erecting wooden buildings without frames; as, for instance, using strips of boards sawed to widths of $5\frac{1}{2}$ and 6 inches. They are laid flatwise, commencing with a 6-inch strip, then a $5\frac{1}{2}$ -inch, and so on, alternating. The outer edges are carried up plumb. The walls are then ready for the plastering without lathing. No regard is paid to the openings for windows until the sides are laid up to the height of the frames. The openings are sawed out and the frames set in. The same with the doors. Finally, cover with siding to prevent storms from driving in.

This makes a cool house in summer and a warm one in winter. Yet it is not so cheaply built as the box frame just described. The use of concrete is considered under the head of cottages, ¶ 111.

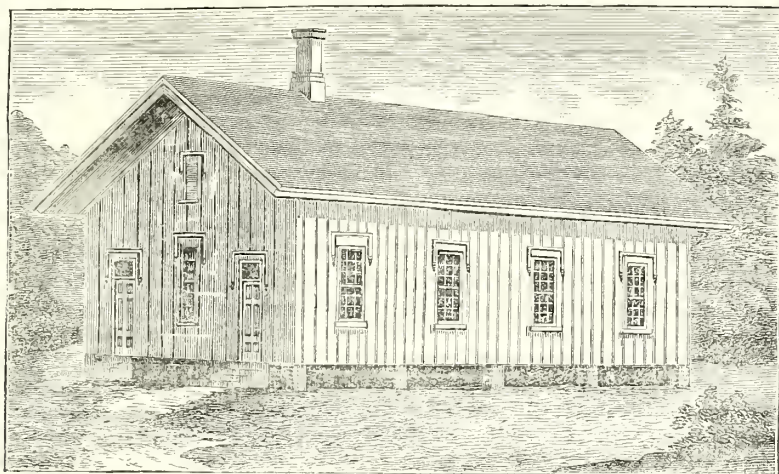


Fig. 9. Design for a Plain Country School-house.

52. In Fig. 9 we have an elevation in perspective of a plain country school-house. It corresponds in style and general construction to the requirements of a school of thirty-five, forty-two, forty-eight, fifty-six, or sixty-four pupils. The ground plans for these buildings are described in ¶¶ 39 to 43, inclusive. The end and side elevations are shown in Figs. 6 and 7. The method of construction is given in ¶ 49. The appearance of the building will be decidedly improved by a good coat of paint, in such colors as will present a pleasing and striking contrast. Suggestions on this point are given under the head of Color of Cottages and School-buildings.

53. The sills are two and a half to three feet from the ground, on piers of brick or stone. When no better material can be procured, sections of red cedar logs or other enduring timber may be used. They are placed six to ten feet apart. Their height is sufficient to admit of air in order to prevent the accumulation of dampness, which, on low lands, occasions mildew, and is prejudicial to health. Care will be taken that the tops of the piers all lie in the same horizontal plane.

Grading may often be necessary before erecting the building to secure a sufficient slope from the house to carry off the water at all times. If the soil be moist, blind drains must be laid through the yard and play-grounds. The platforms at the doors will usually be too small for the children to congregate on, nor is it desirable that they should gather closely around the school-room door. A good coat of gravel on broad walks will be found very useful. Another improvement may be introduced—that of a porch across the whole front end—not to do away with the gravel walks, but to form a shelter for those who come before the doors are opened, and for protection from the sun when the building is located to face the south. It may be observed, however, that if the front doors are towards the north, the pupils, when at their seats, will face in that direction. Many teachers esteem this an advantage when pursuing the study of geography.

Bill of materials and work for school-house, 40 by 30 feet; ceiling, 14 feet; pitch of roof $7\frac{1}{2}$ feet.

	Feet.
Frame, 2 by 6 inches, 1,600 feet long.....	1, 600
Partitions, 3 by 4 inches, 560 feet long.....	560
Sills, 6 by 8 inches, 140 feet long.....	560
Plates, 3 by 6 inches, 140 feet long.....	210
Floor timbers, 30 pieces, 3 by 10 inches, 30 feet long.....	2, 250
Bearing beam, 1 piece, 6 by 8 inches, 40 feet.....	160
Ceiling joists, 13 pieces, 3 by 8 inches, 30 feet long.....	780
Rafters, 28 pieces, 3 by 8 inches, 20 feet long.....	1, 120
Flooring, (surface measure).....	1, 200
Siding, (surface measure).....	2, 200
Roof boards.....	1, 600
Wainscoting.....	600
Boards, for finishing.....	1, 500
Total.....	14, 340
Shingles.....	14, 000
Laths.....	6, 000
Plastering, yards.....	470
Brick, (8 by 4 by 2 inches).....	1, 500
Windows.....	9
Doors.....	4
Nails, kegs.....	10
Carpenters' work, days.....	320
Masons' work, days.....	44

The specifications which follow give some different sizes for the timber from the above. Either will answer. The mechanic will exercise his choice in that regard. The size fixed upon should be inserted in the specifications.

54. *Specification for school-building of wood, one story high, thirty feet front and rear, and forty feet from front to rear, to finish fourteen feet high in the clear of floor and ceiling when done.*

TIMBER.—Floor beams, 3 by 8 inches, placed 20 inches from centres, and will rest on 7 by 9 bearing beam extending from front to rear; this bearing beam to rest on five posts, not less than 7 inches at the small end and 5 feet long; sills, 6 by 8 inches; floor beams framed in plates, 4 by 6 inches, well halved together at the angles. Rafters, 3 by 7 inches, placed 30 inches apart from centres, with collars $1\frac{1}{4}$ by 7 inches, 12 feet long, spiked on each pair of rafters. Ceiling joists, 2 by 8 inches, placed 30 inches from centres, and suspended from the rafters by strips of board. All the above will be good, sound yellow pine.

SIDING.—The building to be what is termed box-framed; exterior formed with $1\frac{1}{4}$ inch matched white pine plank, 16 feet long, with battens, $2\frac{1}{2}$ by $1\frac{1}{4}$ inch, nailed over each joint.

FURRING.—Ceiling furred for lathing on strips, 1 by 2 inches, placed 12 inches from centres; horizontal furring nailed on the inside of the siding boards, placed 20 inches apart, and on them nail vertical strips of furring, 1 by 2 inches, placed 12 inches from centres, and upon these put the lath.

PARTITIONS.—These set with 3 by 4 joists, placed 12 inches from centres; doors placed where shown. These will be 2 feet 10 inches by 7 feet 6 inches.

FLOOR.—Lay floor with $1\frac{1}{4}$ inch yellow pine matched plank, not exceeding 9 inches in width.

ROOF.—Cover rafters with yellow pine boards not exceeding 3 inches apart, and on them put heart pine or cypress shaved shingles, laying them not more than one-third of their length to the weather; the roof to have a pitch of $7\frac{1}{2}$ inches to the foot.

CORNICE.—The ends of the rafters to be planed, with neat finishing boards put on; they will project 3 feet on all sides. Put in each gable a stationary Venetian blind in suitable frame, with slats 3 to 4 inches wide.

VENTILATOR.—Put in ceiling of school-room a fan door, 3 feet square, made of $\frac{1}{2}$ inch matched pine, in neat frame and made to operate with cords.

PLASTERING.—Ceilings and side walls all lathed with good 4 feet sawed lath put on with not less than five nailings. All parts of the building lathed will have two good and sufficient coats of brown mortar, extra well haired, put on and worked down straight and true.

CHIMNEY, (for stove.)—Construct chimney with brick, make flue 9 by 9 inches, this commenced 2 feet below line of ceiling and carried $2\frac{1}{2}$ feet above ridge of roof, and furnished with stove collar and soot drawer; chimney supported on joists standing on the floor.

PAINTING AND GLAZING.*—All wood-work will have three coats of light drab paint; cornice, dressings to doors and windows and water table will all be painted a dark brown. Sashes all glazed with good American glass, well tinned, and set in good putty. Wainscoting in all rooms stained with raw sienna, and will have two coats of raw linseed oil.

WAINSCOTING.—Sides and front end of school-room ceiled up two feet high with half inch yellow pine, not over four inches wide, tongued, grooved, and beaded. Back end of school-room and ante-rooms all ceiled with same material, and will be four feet high. All wainscoting to be neatly capped with proper mouldings.

WINDOWS.—Each window composed of twelve lights of 12 by 18 inches. Sashes one and three eighths inch thick, hung with cords, weights, and pulleys. Frames to be what are termed box frames, all constructed with good, sound, seasoned heart pine. All windows neatly cased on inside and outside.

DOORS.—All doors one and a half inch thick, made in six panels, (three wide,) and will be two feet ten inches wide and seven feet six inches high, made from good, sound, seasoned white pine, hung with cast butts and furnished with cottage locks and brown mineral knobs.

BLACKBOARDS.—Place these above wainscoting between the windows on the sides and the front end. They will be formed of plaster and colored, and will be four feet six inches wide, with neat border of wood on top, and trough at bottom, four inches wide with moulding, for dust brush, crayons, &c. (See ¶ 82.)

For construction of privies, see ¶¶ 70 and 91.

* For common unplanned boards the following recipe will make a good whitewash: Make one bushel of lime into whitewash, in the ordinary way, with about 40 gallons of water; add 20 pounds Spanish whiting, 17 pounds rock salt, and 12 pounds of brown sugar. Mix well; use thin. Apply three coats for outside work.

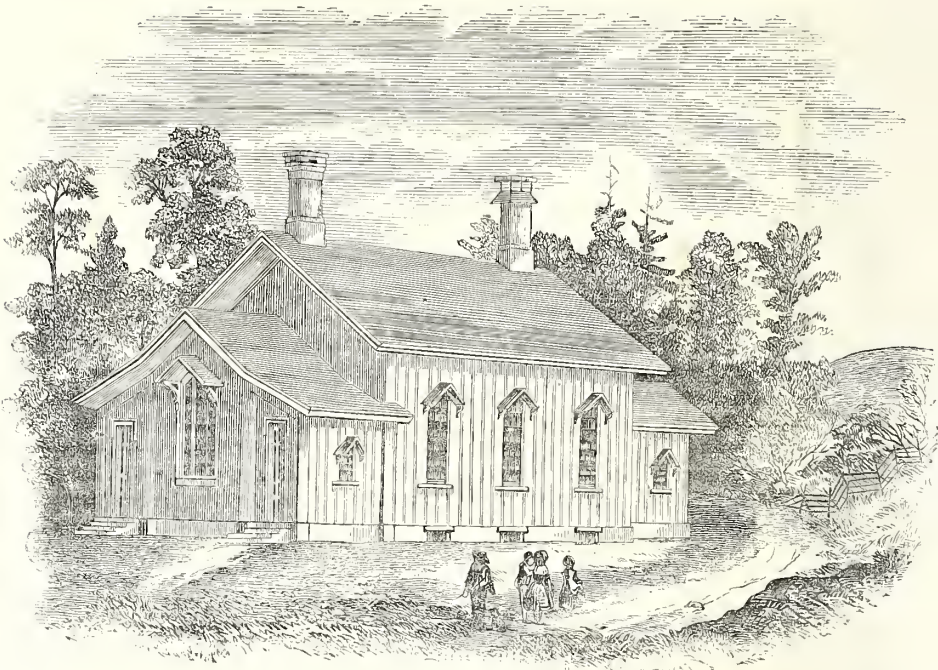


Fig. 10. Design for School-house with Basement.

55. The elevation in perspective is an agreeable illustration of the effect which can be produced by a tasteful application of the rules of architecture without materially enhancing the cost of the building. Had the porch, which includes the teacher's and ante-rooms, been made an inartistic lean-to, the effect would have been strikingly less favorable. All together, the broad, projecting roof, the hooded windows, and the variations in the height of the different parts, are happily conceived. The style may be used in the smaller as well as larger buildings. It may sometimes occur at the time of construction that the large recitation room will not be required. The framing of the main part may have reference to putting on this as an addition when it will be needed. When the recitation room is erected the school officers may employ a competent teacher the year round to conduct the school in the main room. When those pupils who are obliged to remain at home to assist their parents, or earn their own livelihood a part of the year, are able to attend, an assistant may be employed to hear recitations in the room for that purpose. In this way the general progress of all the school will be promoted, and its advancement go steadily forward.

The plan includes a basement under the whole house. In selecting a site it would be well to choose one on a slight declivity, so that the basement may be entered on a level with the surface of the ground. It may be fitted up with benches, and serve as a place for neighborhood gatherings. The school-room is not the place for such meetings. The desks often get damaged and the floors are left in a condition unfit for school-room floors.

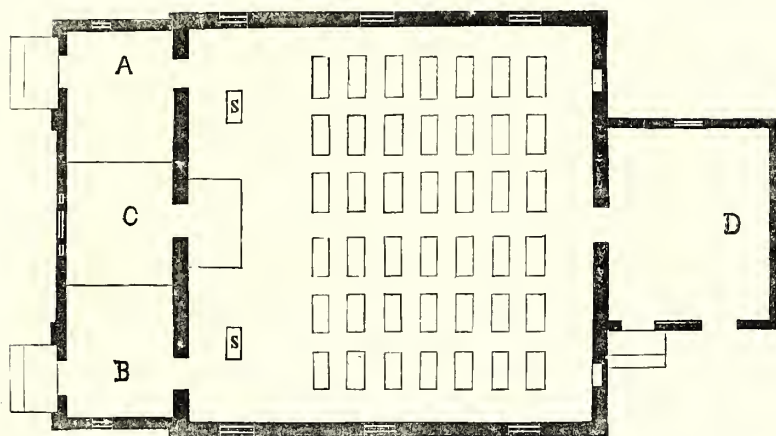


Fig. 11. Plan of School-house for 84 pupils.*

School-room, 38 by 36 feet ; A and B, ante-rooms, 9 by 8 feet ; C, teacher's room, 12 by 8 feet ; D, recitation room, 20 by 16 feet ; H H, desks, (No. 4,) 3 feet 6 inches long ; outside aisles, 3 feet 6 inches ; centre aisle, 2 feet 4 inches ; inside aisles, 1 foot 8 inches ; S S, position of stoves.

It may be noted in passing that frequent changing of teachers is not conducive to the best interests of the school. It takes each new-comer some weeks to ascertain the scholastic attainments of all the pupils, and frequently longer to establish those intimate relations of sympathy and personal regard which are essential to the management of the school by the noblest means and with the most exalted aims.

Bill of materials and work for school-house 46 by 36 feet, with addition 18 by 15 feet.

	Feet.
Sills, 10 by 3 inches, 280 feet long.....	700
Plates, 6 by 4 inches, 160 feet long.....	320
Beams, 6 by 6 inches, 250 feet long.....	750
Posts, 6 by 6 inches, 225 feet long.....	675
Studs and girts, 4 by 3 inches, 4,000 feet long.....	4,000
Floor joists, 12 by 3 inches, 1,550 feet long.....	4,650
Ceiling joists, 8 by 3 inches, 1,500 feet long.....	3,000
Rafters, 8 by 3 inches, 1,800 feet long.....	3,600
Collar beams, 6 by 1½ inches, 340 feet long.....	212
Roof boards.....	6,000
Flooring, (surface measure,) 2,350 (¼ added, 600).....	2,950
Siding, (surface measure,) 4,700 (¼ added, 1,200).....	5,900
Battens.....	1,000
Finishing stuff.....	5,500
Wainscoting.....	800
Total	40,057
Shingles.....	23,500
Doors, (8 by 3 feet).....	9
Windows, 10 by 8 inches, 18 lights.....	9

* This design is copied by permission from *Johonnot's Country School-houses* and modified slightly to suit this work.

Windows, 10 by 8 inches, 12 lights	2
Window, (mullion)	1
Bricks, (8 by 4 by 2)	1, 000
Lath	13, 000
Nails, kegs	13
Carpenter's work, days	450
Mason's work, days	75

Specifications.

56. EXCAVATIONS.—Here state the depth of excavation after having made inspection of the site. The foundations should in all cases be laid below the action of frost. The privy vault is to be 6 feet deep. The earth to be properly graded around the foundation walls. Any surplus not required for perfect grading to be hauled away.

FOUNDATION WALLS are to be well built of (here describe the material,) well laid in good lime and sand mortar, commenced below the action of the frost, to be $1\frac{1}{2}$ foot thick and show 3 feet above grade. The walls to be built to the size of the frame, so that the sill shall be flush with the outside of walls. [When there is no basement, there is to be a centre wall lengthwise with the building for the bearing beam to rest upon. When there is a basement the bearing beam is to be supported with standards underneath, which describe.]

FRAME.—The frame is to be of the sizes stated in the bill of materials accompanying this plan. (Describe the kind of timber to be used.) To be of good sound stuff without any objectionable defects. Timbers that are to be lathed on, to stand not over 16 inches apart from centres. Where black walls (§ 82) are to be made, not over 12 inches from centres. Floor joists 2 feet and rafters 3 feet from centres. Ceiling joists stay-lathed to rafters.

SIDING to be of heart yellow pine, $1\frac{1}{4}$ inch thick and not over 10 inches wide. Joints battened, form as shown in figure 8. Siding well nailed to sills and plates. (If siding is to be planed, tongued, and matched, let that be specified.)

ROOFS to be boarded with sound yellow pine boards, laid with close joints, and well nailed. Shingles (here describe kind and quality) laid not over one-third their length to the weather. Ridges to be finished with saddle-boards six inches wide.

CORNICE.—Ends of rafters to be planed up to the plate and covered with matched plank planed on the under side and let into the rafters the thickness of the plank.

DOORS AND WINDOWS.—(When ready-made doors and windows are used reference should be had to the Table of Dimensions, and their size and description inserted accordingly.) School-room windows to be of 8 by 10-inch glass, 18 lighted; porch and recitation room 12 lights. Sash to be $1\frac{1}{4}$ inch thick. Glass, the best American, to be bedded and back-puttied, and the sash drawn. The front school-room doors 8 by 3 feet, $1\frac{3}{4}$ inch thick. The other doors 7 by 2 feet 8 inches, $1\frac{1}{4}$ inch thick. The larger doors to be hung with three butts each, the smaller with two. One front door to be furnished with a good lock, (describe the kind;) all the others with mortise latches and bolts.

FLOORS to be of sound, well seasoned yellow pine, matched, tongued and grooved, $1\frac{1}{4}$ inch thick, and not over 10 inches wide; to be well nailed, each plank to each joist.

STEPS, of heart yellow pine (if other material, here describe it) 2 inches thick, at each outside door. Risers not to be over 7 inches.

THE CHIMNEYS are to be of well burned brick and to receive the stove-pipes (if stoves are used) 16 inches below the ceilings. Openings for pipes to be fitted with iron thimbles and supplied with close-fitting tin covers.

TWO VENTILATING FLUES are to be made, one on each side of the room, as directed, and one in the recitation room, each 12 by 12 inches inside, made of thoroughly seasoned pine, 1½ inch thick, joints painted with white lead; to unite in the garret and proceed thence to the ventilator top in the roof, which is to be of a capacity equal to that of all the flues which empty into it. There is to be a register near the floor and one just underneath the ceiling in each flue. The openings are to be fitted in such manner that they may be readily closed at pleasure.

PLASTERING, PAINTING, AND WAINSCOTING.—(See specifications, ¶ 70.)

PRIVIES.—(See ¶ 91.)

57. In erecting buildings for more than one school we have the choice of extending our plans over more space on the ground, or erecting houses two or more stories high. There are many reasons in favor of one-story buildings. The pupils of different departments are kept more distinct in going to and from their rooms. This promotes quiet and order. Their yards may be separate. The noise of upper rooms is avoided, and the collisions and confusion which are liable to occur where large numbers are congregated under the same roof and go out to play in the same yards are prevented. The difficulties of lighting, heating, and ventilating large buildings are much greater than in smaller ones. It is, indeed, very rare to find a school building well ventilated which accommodates five hundred or a thousand pupils.

The plans hereafter given are intended to apply to this class of buildings. They are so arranged as to avoid most of the objections noted.

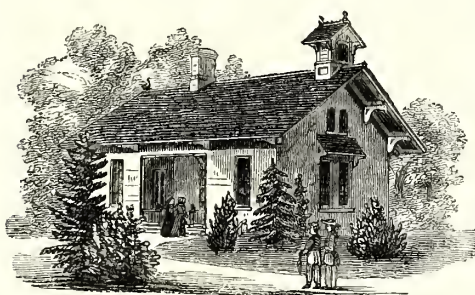


Fig. 12. Vaux's Design for School-house.

58. Vaux, in his admirable work on *Villas and Cottages*, gives us the accompanying design for a school-building, and speaks as follows on the improvement of their style of architecture :

"Even the school itself, in which the earliest and most active germs of progressive thought are commenced, is almost universally a naked, shabby structure, without a tree or a shrub near it, and is remarkable chiefly for an air of

coarse neglect that pervades its whole aspect. The improvement of the school-house is probably the most powerful lever that can be applied toward affecting a change for the better in the appearance of rural buildings generally. All see it, all are interested in it, and all are more or less influenced by its conduct and appearance. It is placed under the control of the leading men in each place, and it might easily be made the most cheerful and soul-satisfying building in the neighborhood, instead of, as at present, a God-forsaken, forlorn-looking affair that is calculated to chill the heart and offend the eye of every thoughtful beholder.

"The cost would be utterly incommensurate with the advantage to be obtained. An extra hundred dollars at first starting would do much. The roof might then have a good projection and be neatly finished. Some sort of a simple porch might be added. The chimney might be slightly ornamented. The rest would then depend on proportion, color, and surrounding the building from time to time with shrubs, creeping vines, and young trees. These, in after years, would offer a welcome shade and give an air of domestic comfort and liberal vitality to the whole effect. A similar result, through precisely similar means, would probably, in course of time, be arrived at in small cottages in the vicinity, and as success would be cheap and invariable, the example would have a fair chance of spread-

ing. Such a building admits of endless variety of design, and is within the reach of every civilized community."

If a community have a poor school-house they will be almost sure to have a poor school. If they would have a better school they must provide a better house. The expense may excite opposition for a time, but it will not be long before those who now despise the school will begin to honor it, and those who hate it and turn from it in disgust will learn to love and cherish it.

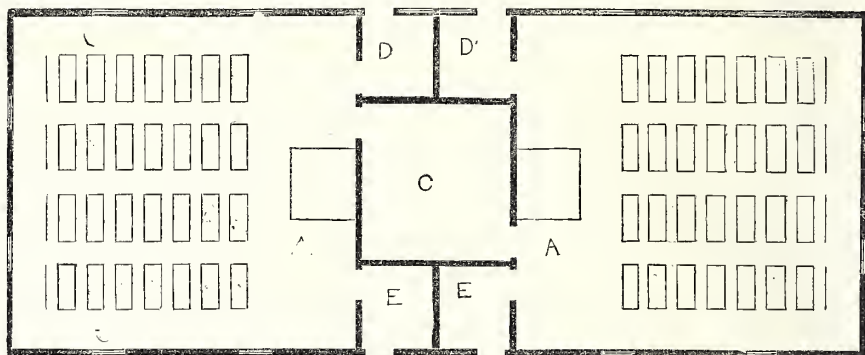


Fig. 13. Ground plan for two Schools.

Explanation of cut.—A A, school-rooms for 56 pupils each; size of rooms, 29 by 29 feet; outside aisles, $3\frac{1}{2}$ feet; inside aisles, 2 feet; front and rear aisles each, 3 feet; E E, boys' ante-rooms, each 8 by 7 feet; D D, girls' ante-rooms, each 8 by 7 feet; C, teachers' room, 12 by 12 feet; outside measurement, 72 by 30 feet.

59. This plan is the result of combining two buildings like the one described in ¶ 52, and shown in Fig. 9. The ante-rooms are retained—those for each school being separate; but the two teachers' rooms are united in one, forming a pleasant recitation room for both schools. There are windows in each of the ante-rooms, and inside windows or fan-lights between them and the teachers' room. Through these air and light can be admitted. The room is warmed by a small stove. One chimney standing in the centre may be made to answer for all the stoves. Should fireplaces be used there would also be a chimney at each end for them.

This building is of the same general construction as shown in Fig. 9. The ground plan is eight feet shorter than twice the length of that design. The building materials may be easily estimated. The siding for the two ends is saved; also a section of both sides eight feet wide, and of the roof fourteen feet. When the size and situation of the lot favors, the house may be set end to the street, to give separate yards for the boys and girls.

As a matter of economy, and perhaps convenience, the outer walls, enclosing the ante-rooms D D and E E, may be omitted. The spaces may stand as open porches, or be enclosed with a balustrade. Hooks or strong wooden pegs may be put up on strips within the recess for the hats and shawls. It would also be advisable to divide the area by a partition of open lattice-work. Then each school would have its ante-room separate; otherwise there would be likely to arise some annoyance by the members of one school interfering with the articles which belong to the other.

60. Since it is a common practice to buy the doors, windows, &c., in the markets, we have added for information a table of dimensions of ready-made sashes, blinds, and doors :

SASH FOR WINDOWS (TWELVE LIGHTED.)		BLINDS.	DOORS.	
Size of glass.	Dimensions.		Style.	Dimensions.
	ft. in. ft. in.		1½ in :	ft. in. ft. in.
7 by 9	2 1 by 3 6	7 by 9	6 panels O G	2 0 by 6 6
8 by 10	2 4 by 3 10	8 by 10	6 panels O G	2 2 by 6 6
8 by 12	2 4 by 4 6	9 by 12	6 panels O G	2 4 by 6 6
9 by 11	2 7 by 4 2	9 by 13	6 panels O G	2 6 by 6 6
9 by 12	2 7 by 4 6	9 by 14	6 panels O G	2 8 by 6 6
9 by 13	2 7 by 4 10	9 by 15	6 panels O G	2 0 by 6 8
9 by 14	2 7 by 5 2	10 by 12	6 panels O G	2 2 by 6 8
9 by 15	2 7 by 5 6	10 by 13	6 panels O G	2 4 by 6 8
10 by 12	2 10 by 4 6	10 by 14	6 panels O G	2 6 by 6 8
10 by 13	2 10 by 4 10	10 by 15	6 panels O G	2 8 by 6 8
10 by 14	2 10 by 5 2	10 by 16	1½ in :	
10 by 15	2 10 by 5 6		6 panels O G	2 6 by 6 6
10 by 16	2 10 by 5 10		6 panels O G	2 8 by 6 8
10 by 17	2 10 by 6 2		6 panels O G	2 8 by 6 10
10 by 18	2 10 by 6 6		6 panels O G	2 10 by 6 10
			6 panels O G	2 10 by 7 0
			6 panels O G	3 0 by 7 0
			1½ in :	
			Moulded one side, raised panels on other.	2 6 by 6 6
				2 8 by 6 6
				2 8 by 6 8
				2 6 by 6 8

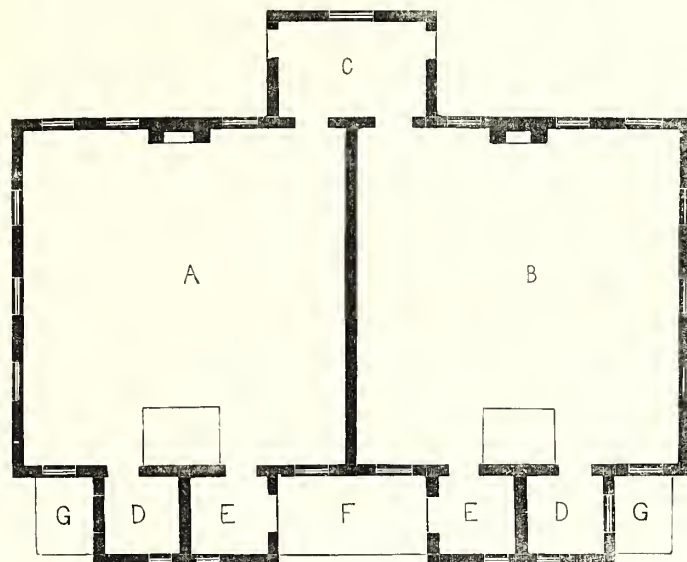


Fig. 14. Plan for Village School.

61. By adopting a different arrangement of the rooms, as shown in the above ground plan, we give an opportunity for the architect to display much taste, and construct a building that will be an ornament to any village or neighborhood.

Explanation of cut.—A and B, school-rooms, 29 by 27½ feet; C, recitation room, 13 by 8 feet; E E, girls' ante-rooms, 7 by 7 feet, opening from F, porch, 13 by 8 feet; D D, boys' ante-rooms, 7 by 7 feet, opening from G G, porches, 7 by 5 feet; size of building on the ground, 56 by 37½ feet.

When the schools do not require the room C for purposes of recitation, it might be made a retiring room for those who wish to study when the rest are at play. But the school-room should not be a place for noise and confusion at any time.

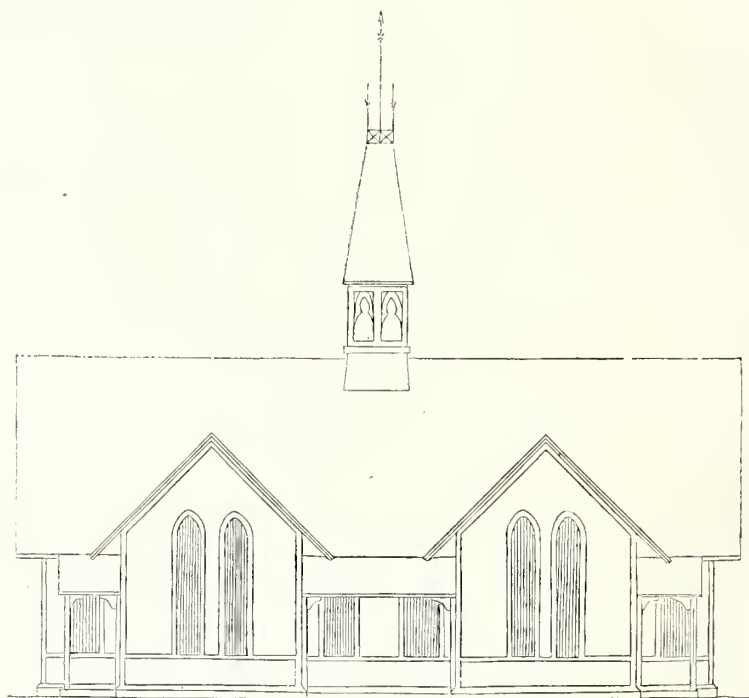


Fig. 15. Front elevation for Village School.

The principal object of this design is to present a finer style of external finish. Those who to-day may have all they can do to provide themselves and their families with the necessities of life will soon have amassed wealth, and will wish to expend something on the decorations of their school-houses. The ground plan includes essentially the same advantages as those of the preceding, though differently arranged. The arcade or recess F between the ante-rooms, the stoop at either end, and the ante-rooms themselves might have been provided for under a plain lean-to roof. The building would then have looked more like a stable than a hall of learning. The tower is for a bell. One weighing about two hundred pounds would summon the children of the village at the hour of school, and secure promptitude in their attendance.



Fig. 16. Side elevation for Village School.

The mechanic will get a clearer view of the design of the building from the two elevations than from an elevation in perspective. From these he may draw enlarged working plans. The ground plan shows two fireplaces, requiring for each a chimney. In case stoves are used one chimney with separate flues may suffice. It might stand in the teacher's or recitation room, which may be enlarged, and perhaps should be, to about 20 by 15 feet.

The directions for tinning under design No. 1, for Normal school, apply to tinning the valleys of the roof of this house. The general construction is simple, and scarcely needs further specifications.

The amount of materials required for this building will not vary much in total cost from that of the last preceding plan. It will take a few more shingles, and will on the whole be rather more expensive. But how much more beautiful is its appearance.

The work of education is not limited to teaching to read, write, and cipher, nor to the pursuit of higher branches of literature alone. It descends to everything with which we have to do, to our houses and our dress, as well as our scholastic attainments and our manners. To be complete it must be generous, impressing not merely a few individuals with its blessings, but reaching out and stamping communities and States with its benign influence.

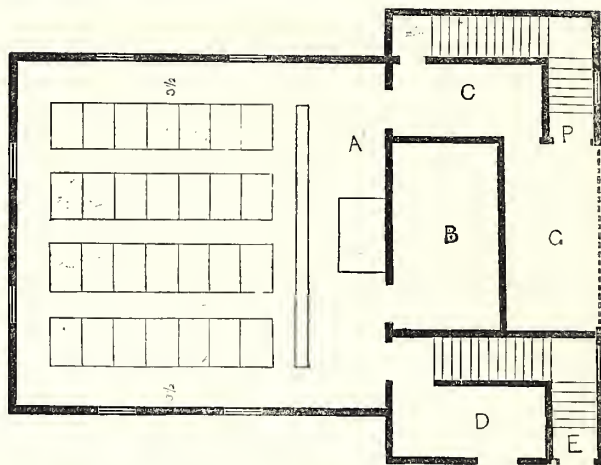


Fig. 17. Ground plan of two-story School Building.

62. The cut represents the ground plan of a two-story building. The two floors have a similar arrangement of desks and seats when both are needed for school purposes.

A, school-room, $30\frac{1}{2}$ by 29 feet; B, teacher's room, 15 by 9 feet; C, girls' ante-room, 14 by 9 feet; D, boys' ante-room, 14 by 9 feet; G, girls' portico, 15 by 8 feet; E, boys' stairway, width, 4 feet; P, girls' stairway, width, 4 feet; width of main part, 30 feet; total length, 50 feet; ceilings, 14 feet.

The arrangement of desks is for fifty-six pupils to each room. In front of the desks, next to the teacher's platform, is a bench for classes during recitations. The chief alteration in size is the addition of four feet to either side at the front to give room for stairs, which also compels an addition to the length of about ten feet. The stairway and teacher's room are lighted by windows in the front, which are so constructed as to add to the architectural effect. The portico G is a pleasant waiting place for the girls who may arrive earlier than the school hour, and at the recess on stormy days when it is not fitting for them to play out of doors.

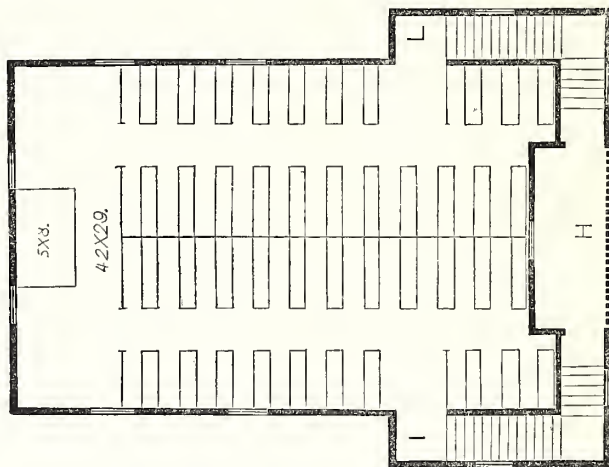


Fig. 18. Plan of second story for Chapel.

The plan is intended to meet a large class of cases where both a chapel and school are wanted in the same building. One flight of stairs is changed so that the recess for the girls is also the platform from which the stairs ascend. The entrances at I L and H are convenient for the audience.

In seating a chapel or an assembly hall the space allowed for a bench or slip is 2 feet 10 inches, and for each adult on a seat 18 inches.

When a tower or belfry is wanted, one of the projections for a stairway may be carried up for that purpose. The accompanying design, by Vaux, is suggestive. It may conceal a ventilator top if desired.



Fig. 19. Belfry.

Bill of materials and work for school-house, 50 by 30 feet; 2 stories high; ceiling 14 feet.

	Feet.
Frame, 2 by 6 inches, 5,600 feet long.....	5,600
Sills, 6 by 8 inches, 200 feet long.....	800
Plates, 3 by 6 inches, 200 feet long.....	300
Girders, $1\frac{1}{2}$ by 5 inches, 200 feet long.....	125
Floor timbers, 50 pieces, 3 by 12 inches, 30 feet long.....	4,500
Floor timbers, 28 pieces, 3 by 12 inches, 38 feet long.....	3,192
Cords, roof, 2 pieces, 2 by 3 inches, 30 feet long.....	30
Cords, roof, 1 piece, 8 by 8 inches, 38 feet long.....	204
Rafters, 4 pieces, 6 by 8 inches, 20 feet long.....	320
Rafters, 2 pieces, 6 by 8 inches, 24 feet long.....	192
Rafters, 3 by 6 inches, 1,000 feet long.....	1,500
Purlins, 6 by 6 inches, 300 feet long.....	900
Bearing beams, 2 pieces, 8 by 12 inches, 50 feet long.....	800
Partitions, 4 by 3 inches, 1,700 feet long.....	1,700
Flooring, surface measure, $3,100 + \frac{1}{4}$	3,875
Siding, surface measure, $5,600 + \frac{1}{4}$	7,000
Roof boards.....	3,000
Boards for cornice, base, stairs, &c.....	4,000

TOWER.

Timber, feet.....	2,000
Plank and boards.....	2,000
Spikes and nails.....	2
Carpenter's work, days.....	30

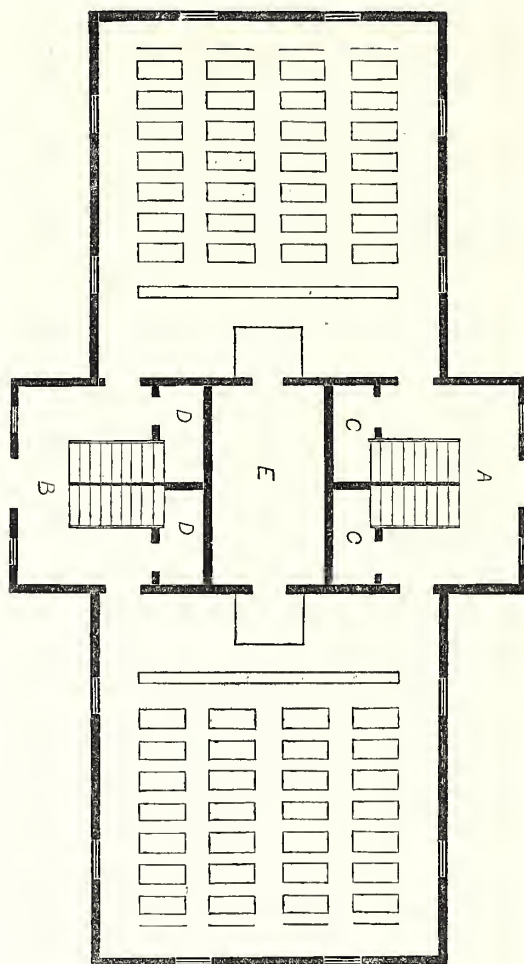


Fig. 20. Ground plan for Union School.

School-rooms, each $30\frac{1}{2}$ by 29 feet; A and B, ante-rooms, 17 by 13 feet; C C, closets for hats, &c., 8 by $3\frac{1}{2}$ feet; E, recitation room, 17 by 10 feet; size of building, 80 by 30 feet; projections for the stairways, 17 by 6 feet; ceilings, 14 feet.

64. After what has already been said in the description of plans no further comments are needed respecting the present design. It would suggest itself to any one acquainted with school management that the doors to the recitation room should be placed so as to be entered directly from the school-room floor instead of the teacher's platform. The closets will be separated from the halls by low plank partitions, not over seven feet in height. The recitation rooms will be lighted and ventilated by fan-windows placed above these partitions.

This design is well adapted for a large village school. It would require four teachers—one to each of the rooms. When the number should increase beyond the capacity of the building, some of the advanced pupils might study mostly at home, and attend recitations in the recitation rooms. When filled it would

accommodate two hundred and twenty-four pupils. With this number an advance might be made in grading.

Where there are twice this number of pupils in a village or thickly settled rural district, many prefer to have smaller buildings for the primary pupils, located so as to gather in enough for a school of that grade. Then collect all the higher grades into the principal building, which would be the high school, and should be centrally located.

A side elevation, Fig. 21, shows the style of frame proposed for this building.

65. THE BALLOON FRAME is a favorite style of constructing medium-sized buildings in the West. It has of late grown in favor in the East. It is less expensive than the old style of posts and beams, and is rapidly erected. The frame is composed of 2 by 5 joists in the smaller buildings; in the larger, 3 by 6 joists. Nails and spikes are used instead of mortise and tenon. By a judicious use of them every part of the frame may be fastened firmly together. After the sheathing is on and well nailed, a building of this kind would blow over bodily before its sides would be crushed in or "blown down."

DIRECTIONS.—Frame the sills and floor timbers the same as in ¶ 49. Before laying the floor timbers determine on the distance between the studs and place them to correspond. They should be either twelve or sixteen inches apart from centre to centre, in order that the lath, which is four feet long, may break joints on the joists.

Some builders mortise the sills to receive the feet of the studs. This is a mistake. It is better only to nail them. Cut the studs to the length required before raising them. No beam is used for a girder. Instead of this an inch board, six or eight inches wide, is taken. When 3 by 4 studs are used gain them half an inch; 2 by 6 or 3 by 6 joists are gained an inch for the board which it is to serve as a girder. When this is done, set up a stud by the side of each floor timber. Toe them down to the sills and spike them to the floor timbers. Plumb and stay them.

A corner post is formed by spiking together two, or if the size require, three, of the joists.

The ends of the buildings are set up the same way, except that the girders are gained in as high as the top instead of the bottom of the floor timbers.

The next thing is to set the partitions, which run crosswise of the floor timbers. Those that run with the floor timbers may be put up after the timbers are in place. Lay a floor timber against each stud and spike it to the stud. Let their ends go out flush with the outside of the frame.

It is much better to have the staff for the studs sawed to order their full length than to be obliged to splice them. But if some are too short, square the ends to be spliced, stay the lower portion, and set the upper joist on it without regard to length, and stay it. After the timbers for the second floor are laid, cut a strip of board the right length for a measure to cut the studs by. Mark each one separately by this and saw to the line. This is a better way than using a chalk line, because the line sags. In splicing the joist, again we say, *square the ends of both*, so that each shall fit exactly to the other. To make the joint perfectly secure take two strips of boards three or four feet long and of even widths with the stud; nail one on each of the two sides in line with the row of studs.

This caution will naturally suggest itself: When short studs must be used they should not be placed all together, but should be separated by one or more full-length timbers.

In setting up the studs and in sheathing no regard is paid to the openings for doors and windows. This is taken into consideration at a later period of the work, before siding up. They may then be sawed out wherever the plan requires.

When the frame is not to be sheathed before the siding is put on, it may be braced in a very simple and effective manner. The direction of braces is shown in the engraving. Also the method of framing a tower. The design, Fig. 19, is preferred to the one here given. The roof is rather too flat for shingles. The width of building is thirty feet. The pitch of roof should be seven and a half to ten feet.

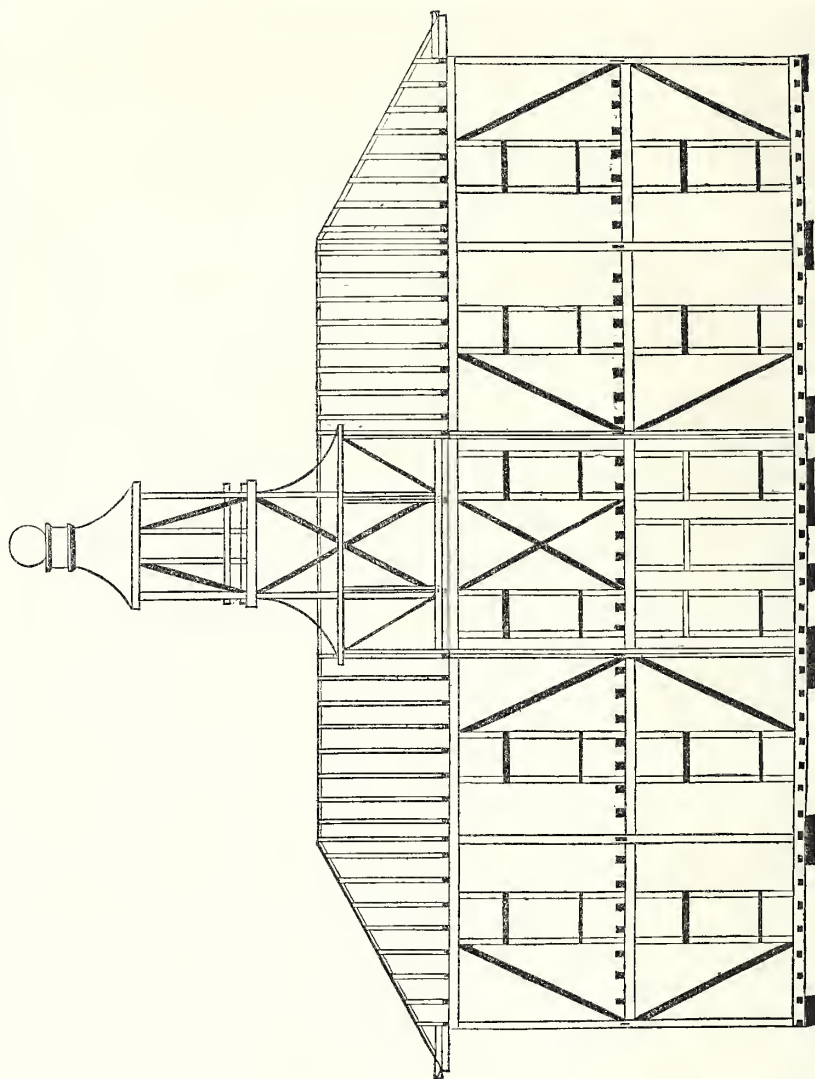


Fig. 21. Side elevation. Balloon frame.

For a brace we take a strip of board six inches wide, lay it on the outside of the joists; mark them by it; gain out the studs the thickness of the board-brace; fit its ends to their places; nail it to each of the studs. The longer the brace the more effective it is. It will be perceived, by a glance at the cut, that braces might be carried up the entire height of the side from sill to plate without interfering with the windows. With the addition of a few such braces the frame would be very strong, much stronger than a frame constructed after the old methods.

It is not necessary to go minutely into the description of all the larger plans which follow. Their construction requires enlarged drawings, in detail, by a skilful architect who is acquainted with the erection of this class of buildings. Attention is directed to the comprehensive specifications given in ¶ 70 for a large and expensive building. The combination of several school-rooms in one edifice

admits of a great variety of arrangements, and much skill may be displayed in their design. It may be mentioned, in passing, that a leading feature should always be, in hot climates, to expose the several rooms to the free passage of prevailing air currents. For this reason, if for no other, they ought not to be built in solid squares, as is commonly practiced in the North.

Bill of materials and work for a two-story balloon-framed building 80 by 30 feet; ceilings, 14 feet; projection of roof, 3 feet; pitch, 7½ feet.

	Feet.
Frame, 2 by 6 inches, 8,050 feet long	8,050
Sills, 6 by 8 inches, 254 feet long	1,016
Plates, 3 by 6 inches, 254 feet long	381
Girders, 1½ by 5 inches, 160 feet long	90
Floor timbers, (96 pieces,) 3 by 10 inches, 30 feet long	7,200
Floor timbers, (30 pieces,) 3 by 10 inches, 27 feet long	2,075
Floor timbers, (30 pieces,) 3 by 10 inches, 17 feet long	1,275
Ceiling joists, (28 pieces,) 3 by 8 inches, 30 feet long	1,680
Rafters, (58 pieces,) 3 by 8 inches, 20 feet long	2,320
Diagonal rafters, (8 pieces,) 4 by 8 inches, 25 feet long	532
Girder, (1 piece,) 8 by 10 inches, 80 feet long	532
Girder, (2 pieces,) 8 by 10 inches, 32 feet long	426
Partitions, 3 by 4 inches, 2,400 feet long	2,400
Roof-boards	3,500
Flooring, (surface measure,) 4,800 (¼ added, 1,200)	6,000
Siding	8,000
Wainscoting	2,700
Finishing stuff	4,000
Total	52,127
Shingles	30,000
Lath	30,000
Windows, 10 by 16 inches, 24 lights	24
Windows, 9 by 16 inches, 18 lights	8
Window blinds, pairs	32
Doors, 3 by 7 feet	12
Doors, 2 feet 10 inches by 7 feet	8
Doors, double, 5 feet 4 inches by 9 feet	2
Nails, kegs	20
Bricks, (8 by 4 by 2) ..	4,000
* Plastering, yards	1,960
Carpenters' work, days	700
Masons' work, days	100

* No allowance for blackboards and wainscoting in amount given.

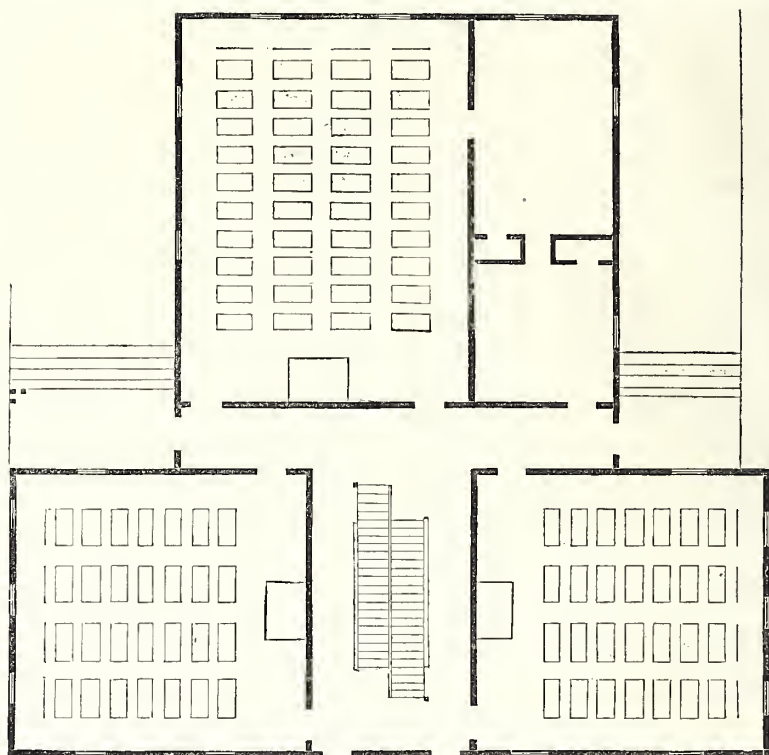


Fig. 22. Ground plan for High School.

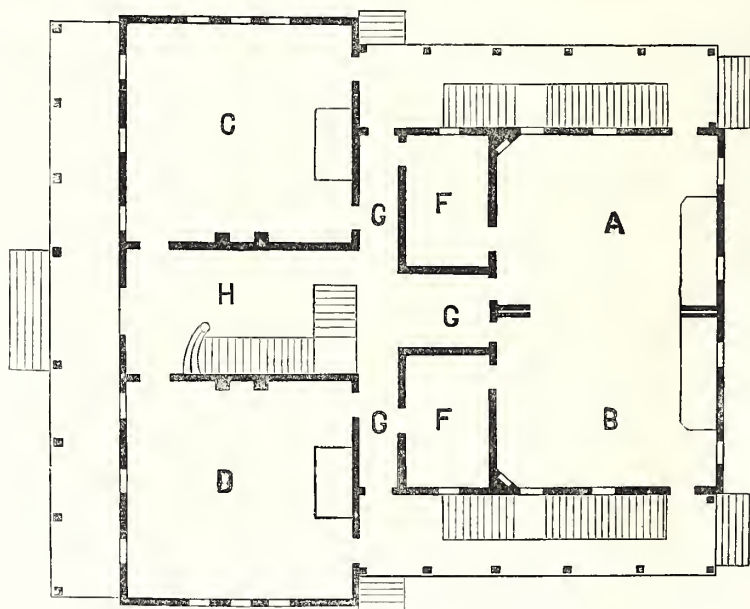


Fig. 23. Ground plan for Normal School No. 1.—Scale, 24 feet to 1 inch.

66. It is difficult to group a large number of rooms together in the same building without obstructing the free circulation of air through some of them. The cut (Fig. 22) shows a combination of three school-rooms, with principal's office and a large recitation room for the advanced school adjoining. The yards for boys and girls are on either side of the house. They have separate stairways. The stairs are placed in the centre of the hall to allow a full passage of air on either side. The halls afford ample room for closets for cloaks and hats. The second floor has two school-rooms identical with those in the front on the ground plan. A chapel is over the back hall, the large school-room, and the side rooms. The seats are arranged in the same manner as represented in Fig 28. There may be an upright plank partition seven feet high across the rear end of the chapel, corresponding to the partition on the ground floor directly underneath it.

67. We have here (Fig. 23) an approved plan for a small Normal School. The rooms A and B are separated by folding-doors, and may be used for the experimental department of the school; G, halls leading to the rooms; F F, principal's office and recitation room; H, front hall with stairs leading to second floor; C and D, school-rooms. The two front rooms over C and D are planned in the same manner. The remainder of the second story is devoted to a chapel, as shown in Fig. 28. The second floor is also reached by outside stairs on the piazzas. A library may be arranged for in the front part of the upper hall between the school-rooms, and light admitted to the back hall through glass windows in the

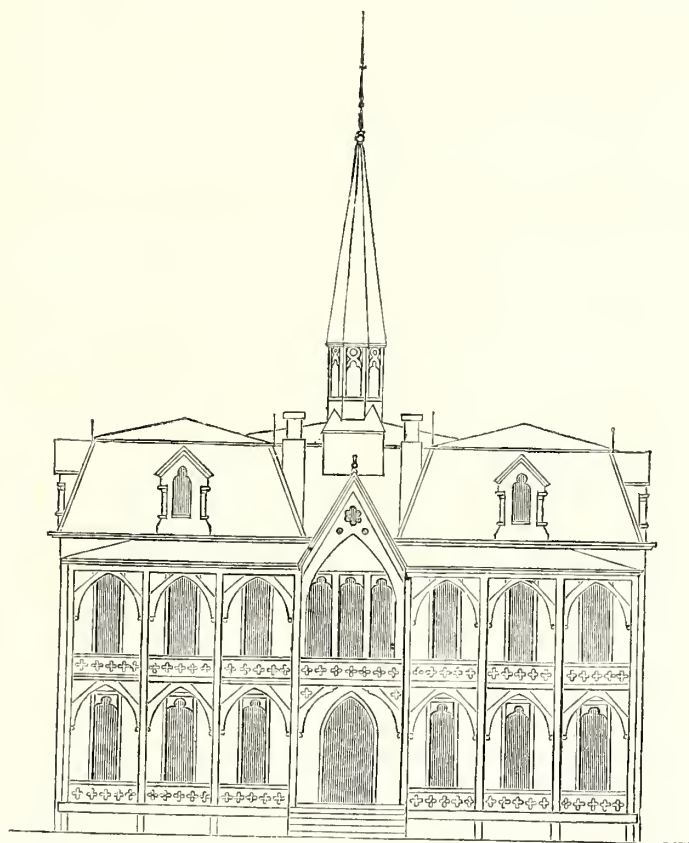


Fig. 24. Front elevation for Normal School No. 1. Elevations and accompanying directions by Littell, architect.

separating partition. All the rooms are arranged with a regard to the greatest amount of air, and at the same time are shielded from the excess of light and heat.

Figures 22, 23, and 26 are modifications of the same general outline.

The cultivated eye will detect in this design much to admire. It was planned for site on a battle-field, looking southward up a magnificent river. All the pupils when at their desks will face the north. The piazza in front will shield the building from the severest rays of the sun. The attic may be reserved for the janitor and for enlarging the school. The tower is to be supplied with a bell weighing over three hundred pounds.

It is not an uncommon practice in the South for stairs to ascend from the piazza. The piazza itself is one of the much needed devices as a protection against the heat, and there is no strong objection against the above arrangement. In the plans proposed it saves much room inside the house.

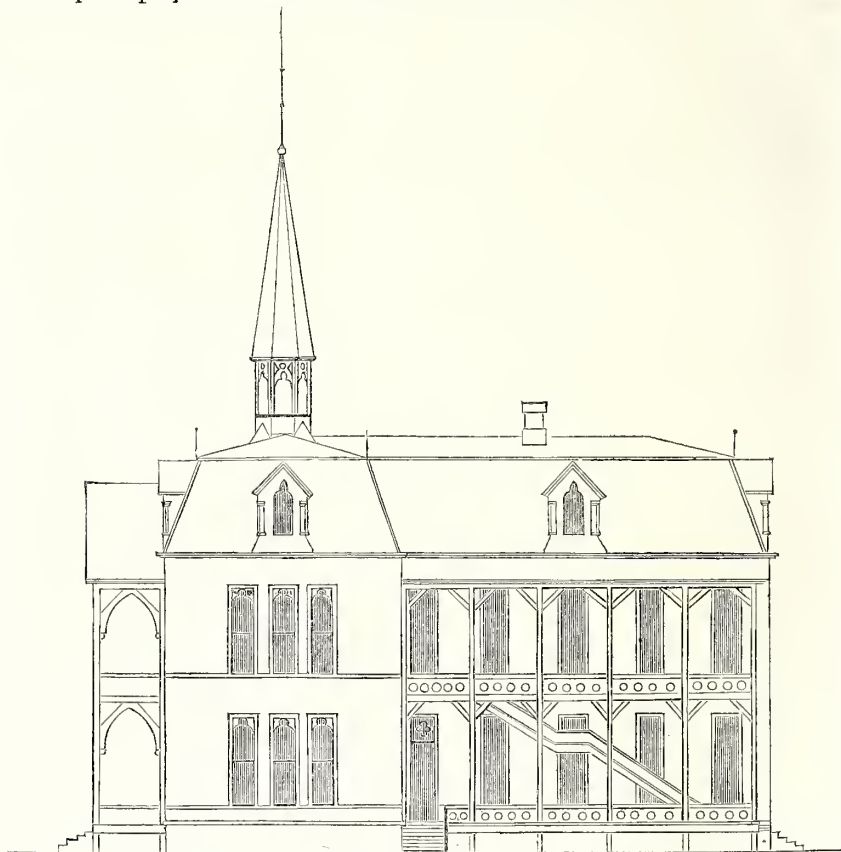


Fig. 25. Side elevation for Normal School No. 1.

The side elevation represents the position of the stairs by which the second story is reached by the pupils. A landing half-way up breaks the continuous effort of rising, and is therefore an advantage. The pupils who belong in the rooms of the second story have no occasion to go on the piazza with those of the first. This conduces to quietness and good order at the gathering and dismissal of school. In some of the large cities it has become customary to use the attic for one of two purposes, either as an assembly hall or for a play-room for girls in bad weather. In the design the ceiling would admit of this arrangement. A few more windows might be added.

68. GENERAL REMARKS ON MATERIALS AND CONSTRUCTION.—The sills are to be supported by piers of brick-work, hard, well-burned brick, nowhere more than 10 feet between centres. These piers to be 20 inches square and to rest on a concrete bed 10 inches thick and 3 feet square.

FRAME.—The sills should be of yellow pine, approximately 8 by 14 inches; the corner posts 8 by 12 inches; girts 4 by 14 inches, into which the second and third story joists are framed; intermediate posts, 4 by 8 inches; studs, 3 by 4 inches; rafters, 3 by 7 inches; floor joists, 3 by 12 inches. The veranda posts should be about 10 inches square, corners chamfered; the arched braces 6 inches thick. The railing to be 5 by 6 inches square, upper and lower rails with 2 inches thick pierced filling between.

SHEATHING AND FLOORS.—The outside of building should be sheathed with diagonal sheathing an inch and a fourth thick, well nailed, of yellow pine plank or similar wood. The under side of floors should be furred off with 2 by $1\frac{1}{2}$ inch strips set 12 inches between centres ready for lathing. The floors should be deadened with mortar laid on boards, cut in between the joists, resting on fillets nailed to the side of the joists.

THE ROOF should be sheathed on the flat part with $1\frac{1}{4}$ plank laid as close as possible, tongued and grooved if it can be done. The flat should be tinned with good roofing tin. This should run over the edges of flat, and lap 8 inches on the inclined sides. The veranda roof and deck of bell turret are finished in the same manner. The inclined sides of roof should be shingled on shingle strips $2\frac{1}{2}$ inches wide, set as far between centres as the shingles show to the weather. The hips and valleys are to be covered with tin at least 18 inches wide, turned over a strip and under the shingles. Around the chimneys and dormers there should also be careful flashing. A gutter is to be formed at the bottom of the pitched roof, and to have false bottoms to throw water leader. Said gutter to be lined with tin, turned up at least a foot higher than the top line of gutter under the shingles. There should be six $3\frac{1}{2}$ by 4 inch tin leaders at angles of building running *straight* to the ground.

THE WINDOWS should be rising sash, except in those of the assembly-room, which should be casement and glazed with first quality American sheet glass.

THE STAIRS to second story should have twenty-five risers and heavy balustrade, continued string stairs.

DOORS in first story should be ten feet high or thereabouts, and $1\frac{3}{4}$ inch thick, except sliding door, which should be $2\frac{1}{4}$ inches thick. Outside doors $2\frac{1}{4}$ inches thick.

PAINTING.—The buidling should be painted a quiet gray tint for the body of the wall, and a quiet purplish brown for the trimmings, and sanded. The shingles and tin should be painted slate color.

A building of this kind should be erected under the directions of an accomplished architect.

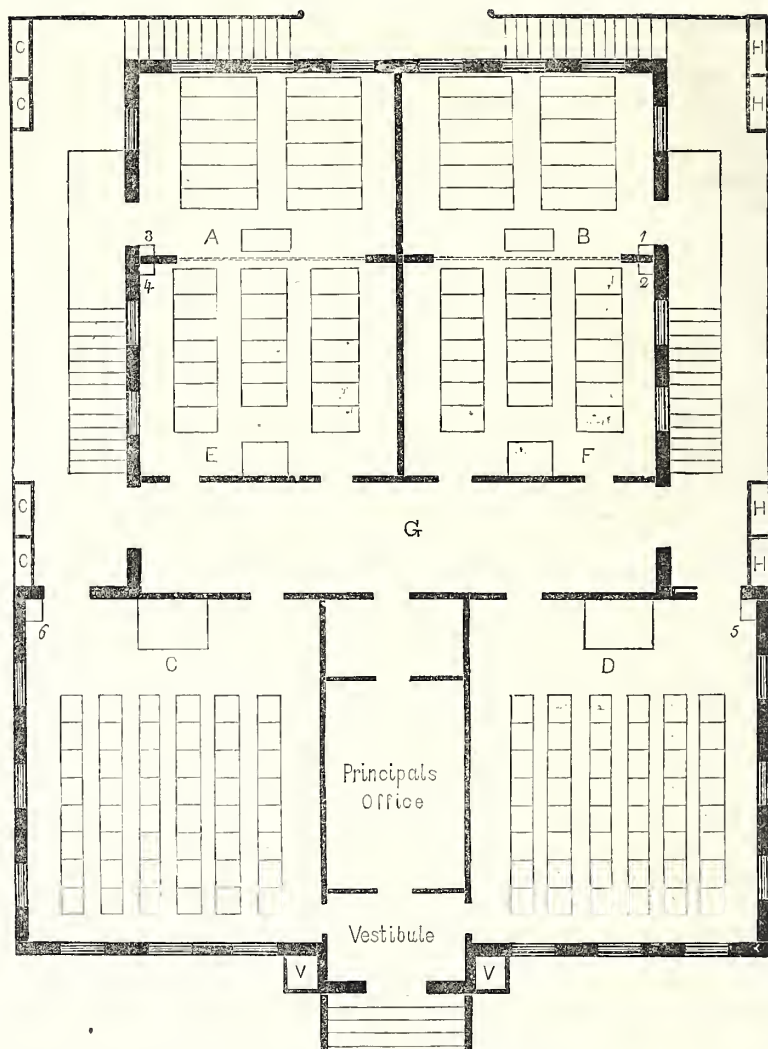


Fig. 26. Ground plan of Normal School No. 2.

69. This building was designed for a situation where the prevailing winds were from the south and blew directly off the ocean. It was desirable to secure their favoring breath through each of the rooms. Hence the projection of the rooms allowing space at the side or over the top of the door for windows or fan-lights to admit the southerly winds.

The rooms C and D are seated for 48 pupils each, at single desks. They constitute the preparatory department. The two corresponding rooms on the second floor, for the graduating class, are of the same size and seated in the same manner. The four rooms A E and B F are for the Model or Experimental school, in which the graduating class will practice in the art of teaching under the instruction of an accomplished teacher. The rooms are for forty pupils each, and are separated by folding-doors. The advantage of this is to enable the principal instructor to give general exercises to two of these schools at a time. H H are the positions for hat closets for the boys, and C C for the cloak

rooms for girls. The figures denote the positions of the chimneys and ventilators. V V, also, are for ventilating the four principal school-rooms. The hall G is of ample width. The principal's office is lighted through the glass partition between it and the vestibule, also by fan-lights connecting with the school-rooms. The front windows of the vestibule are not shown in the engraving. On the second floor, directly over the vestibule, is a library; in rear of that the lady teachers' toilet. The building is calculated for three hundred and fifty pupils.

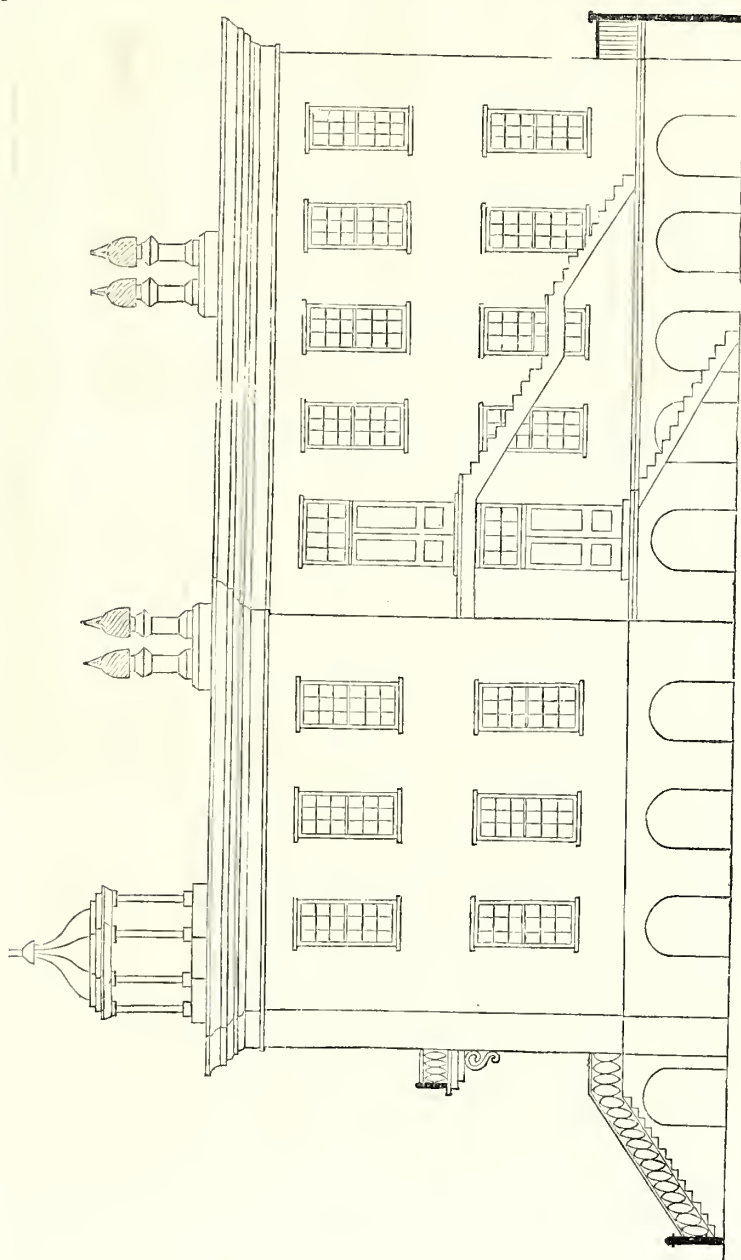


Fig. 27. Side elevation of Normal School No. 2

The ground plan shows the general form of the building and the side elevation, the ascent by the stairs from the ground, &c. Our space would not admit of complete illustration; but the specifications which follow give definite descriptions of the construction, and will assist in a full understanding of the entire plan. The front is entirely plain, without decoration except that which the veranda and projection at the entrance give. Probably a little more attention to artistic effect would have benefited the design without materially increasing the expense.

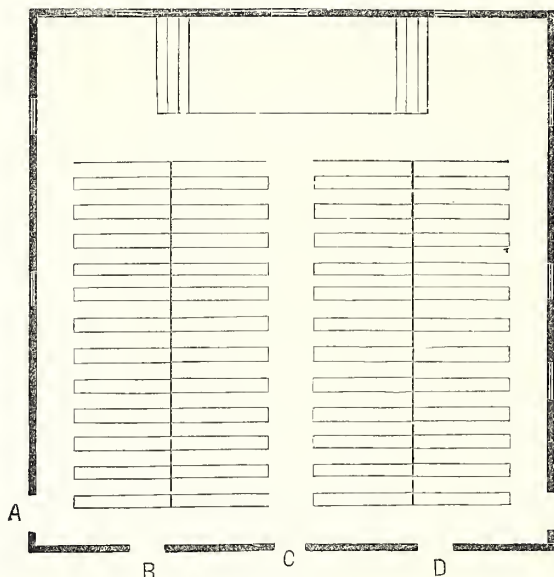


Fig. 28. Chapel.

That portion of the second story over the Model School rooms and the hall G is arranged with settees to accommodate all the pupils of the school. The platform is elevated several feet, and is large enough for the teachers to occupy during morning exercises. The pupils from the lower room enter the chapel by the doors A and E; those from the upper, through the other doors, B, C, and D. (See ¶ 63)

The basement is open to the yard by the arches between the piers. It is divided by a wall running lengthwise, and forms a most excellent shelter for the pupils from the hot sun and showers. The

wash-rooms, supplied with an abundance of water from the cistern, enable the teachers to enforce cleanliness.

The specifications which follow will serve not only as a guide in the construction of large buildings, but they contain valuable directions applicable to those of a smaller class, whether of brick or wood.

70. *Specification of the work and material for erecting a brick school-house, all to be finished as per plans and this specification, in every part complete.*

DIMENSIONS.—The building in front to be sixty-seven feet, and to extend back thirty-three feet, same width. Then a recess of ten feet, to be formed on each side, making the rear part of the building forty-seven feet wide by fifty-five feet deep; total depth of eighty-eight feet, to have two stories and basement. The basement to be eight feet from the top of the ground to ceiling, the openings to be arched, as shown on plan. The first story to be thirteen feet from floor to ceiling, and the second story to be fifteen feet in the clear when finished. The roof to have one and a half inch to the foot descent from centre to each side. Put up a belfry on roof, as shown on plans, 7 by 7 feet, octagonal form, ten feet in height.

FENCES.—A front fence to be put up the whole front of lot, with gateways as marked on plan, with brick posts of good, sound, hard-burned brick well laid in cement, neatly coped with bluestone, four inches thick, finely axed. Posts to be placed about eight feet from centres, and to be eighteen inches square. Also

build into the posts, where required, strong wrought-iron eyes, well anchored in the posts, to hinge the gates. Pickets of fence to be two inches square. Rails 6 by 3 inches, mortised to receive the pickets; all to be smoothly planed.

A board fence is to be put on each side and rear of lot; also from the centre of the back of building to the line of lot. Posts to be 6 by 6 inches, set 2 feet 6 inches in the ground. Boards to be one and a quarter inch thick, smoothly planed, well nailed to the rails. Said fence in rear and on sides to be seven feet high.

TRENCHES to be excavated two feet below ground under all walls, four feet in width. All earth excavated from trenches, vaults, &c., not used for building purposes, nor required for grading, to be carted away from the premises, and the whole to be left clean. Also all dirt, refuse, and rubbish to be removed from premises when the work is completed.

THE FOUNDATIONS are to be laid two feet below the level of the ground, on a bed of hard yellow pine plank four feet wide and four inches thick, firmly bedded and levelled, laid close joints across the trench in the best manner to receive the brick walls. Piers to be of hard-burned brick, laid in the best manner to support the posts of platforms and stairs.

BRICK WORK.—The walls below a level of the ground to be three feet thick, well laid up with good, sound, hard burnt brick. All outside work to be of the best quality hard-burned gray brick. Walls filled with good hard-brown brick. All of the walls to be eighteen inches thick from the level of the ground to the top of second story* floor beams, except the interior wall running across the front part of the building, which will be twelve inches thick from the foundation wall to top of first story floor. All the residue of walls to be twelve inches thick, carried up above the roof, as shown on the plans. All flues to be carried up as shown on plans, neatly pargetted on the inside, and carried up above the roof to a suitable height and coped. All brick for the side walls to be of the best quality of hard-burned brick, well laid in the best quality of lime and sand mortar, above ground full flush joints to be well bound every fifth course. The outside joints to be struck full flush, neat joints. Walls to be well anchored to the beams with iron anchors placed about six feet apart. The rear wall to be carried up above the roof, coped with bluestone coping, neatly pointed with cement; said coping to be put on after the tin roofing is turned over the wall.

PAVING.—On each side and in rear of building, as far as the lot extends, the ground is to be paved with hard-burned brick, laid herring bone, close joints—none to be laid in front, except on the entrance and the side-walk in front of the lot.

GUTTERS to be formed in the yard of suitable sizes, with brick laid in cement to drain the water. Put up bluestone sills and lintels to all the windows, and outside doors of good, sound bluestone, neatly axed; also put up bluestone steps and platform to front door stoop. Platform to be two feet wide, running under the door sill one and a half inch, making two feet one and a half inch wide. Steps to be eight feet in length, twelve inches wide, laid on brick foundation, arched, as shown on plan. Put up on each side of said stoop a neat substantial iron railing, with newels, &c., complete.

A CISTERN to be built in rear of lot, ten by fifteen feet, oval form, six feet deep, to be built with good, sound hard brick laid in cement, and plastered with cement out and inside; 12-inch outside walls, with 4-inch centre walls, properly prepared to filter the water passing from one side to the other. The bottom to be laid double thick, well cemented, the top to be neatly arched, and to have a bluestone neck rabbeted together, the arch to be well grouted with cement on top, and the whole warranted water-tight; also place a piece of bluestone in the bottom where the water falls into it.

* In smaller buildings the walls need not be over twelve or nine inches thick.

FURRING, LATHING, AND PLASTERING.—The walls to be furred with one by two inch furring strips, nailed on wall strips in wall twelve inches from centres. Also, the ceilings to be cross-furred crosswise of beams, twelve inches from centres, except the ceilings of basement, which are to be lathed on the beams; and all to be lathed with $1\frac{1}{4}$ -inch sawed lath, well nailed, and plastered with two good coats of the best quality of lime, with clean long hair and sharp sand mortar mixed in proper proportions; and the whole to be finished with one good coat of white hard finish mortar put on in the best manner, complete in every part.

CARPENTERS' WORK.—The floor beams of first and second stories to be 3 by 14 inches of good sound timber, free from any objectionable defects, placed on the walls as they progress, not over fifteen inches from centres, with two rows of cross-bridging on each side of partition, and to have anchor strips let in three beams from wall opposite each pier. All the floor beams, which are anchored in the wall, to lap over the partitions, and be spiked firmly together. Beams under roof to be 3 by 10 inches, laid not over eighteen inches apart, framed into a centre, girded 8 by 10 inches, running the length of the rear part of said building, supported by three neat iron columns, five inches diameter, equally divided in assembly room. The rafters to be 3 by 8 inches, placed and footed on the end of each beam, bolted together with one-inch bolts with large heads, screws, and nuts, and large washer-plates, supported and braced, as shown on plans, with iron bolts one inch thick securing each rafter to the beam, as shown. All the above timbers to be of good, sound lumber, free from any objectionable defects, framed in every part in the best manner, neatly levelled on the walls. Furnish and put up all centres, wall strips, wall blocks, wooden lintels, and loose furring required by the masons.

The stoop platforms are to be framed, one with a front plate 4 by 9 inches and cross-ties placed about 6 feet apart, 4 by 8 inches, and filled in with 3 by 8 inch beams, placed 2 feet from centre. The cross-ties are to run in the wall 4 inches, and be well fastened with iron hold-fasts built in the walls as they are put up. Said platforms to be supported on posts 8 by 8 inches with neat smooth caps and bases as shown.

WINDOW FRAMES AND SASHES.—All window frames, as shown on plans, are to be box frames with $1\frac{1}{4}$ -inch pulley stiles, $\frac{3}{4}$ -inch outside and inside casing, $1\frac{3}{4}$ by $1\frac{1}{4}$ inch hanging stiles, $1\frac{1}{2}$ rabbeted sills; all to be fitted with stop and parting strips and $1\frac{3}{4}$ -inch iron, best quality, frame pulleys, 4 pulleys to each frame. All are to be put together in the best manner, placed in the wall three feet from floor. Sashes to be $1\frac{3}{4}$ inch thick, 12 by 15 inch glass, glazed with thick German glass, free from burns, stains, or other defects, well bradded and puttied. All are to be double-hung with best quality of sash cord and cast-iron weights, properly balanced and neatly fitted to the frames. The windows are to be trimmed inside, also all inside doors, with a $\frac{5}{8}$ -inch returned bead casing, $1\frac{1}{4}$ -inch oge back-moulding, and 1-inch back bands, 6 inches wide when finished; all to be neatly fitted to the walls. All doors to have $1\frac{1}{4}$ -inch jambs rabbeted to receive the doors. The jambs to be well blocked to receive the screws of butts and nosings. Put up inside all around the walls and partitions $\frac{3}{4}$ -inch narrow tongued and grooved boards for wainscoting, not over 5 inches wide, placed upright and finished with a neat $1\frac{1}{4}$ -inch nosing and core cap on top of the same, (all the partitions to be of 3 by 6 studs 12 inches apart, properly braced to carry posts in assembly hall in second story.) Window trimmings to be finished on said cap, and all around the bottom of wainscoting running all around the various rooms and halls put down $\frac{3}{4}$ -inch base with oval moulding, 8 inches wide, neatly fitted to the floor.

VENETIAN BLINDS to be placed inside of each window $1\frac{1}{4}$ inch thick, made flatwise, to be cut in centre and back flap and hung with suitable sized butts, and fastened in the centre with hook, latch, and staples in the usual manner.

SLIDING DOORS.—In the first story a glass sliding partition is to be put across both rooms in the rear part, as marked on plans, to be divided in four sections in width in each room. Sliding doors to be nine feet high, and above the doors to ceilings is to be filled in with sashes. All to be put up with suitable frames, &c. Doors to slide on brass ways screwed down to floor, and 8-inch brass sheaves let in the bottom of the doors in the usual manner. Doors to be $1\frac{1}{2}$ inch thick, panelled and moulded below the sashes about three feet in height from floors. All the above to be put up in the best approved manner and complete in every part.

DOORS AND FAN-LIGHTS.—The outside doors are to be 2 inches thick, double fold, as shown on plans, 5 feet wide, 8 feet 6 inches in height, with cast-iron filigree panels above and small $1\frac{1}{4}$ -inch sashes inside, hung with 3 by 3 inch butts, and fastened with buttons. Also, to have circular fan-light: on front and square fan-lights on side doors, as shown. Strong and suitable jambs to be fastened to the walls, trimmed inside same as inside door and window trimmings, and with a large moulding outside. Said doors are to be moulded on the lower panels with large raised mouldings, and on inside same as other inside doors.

Sash-doors are to be put in the principal's office and in teacher's room in second story; also two sashes in each side partition in these rooms for borrowed lights. Sashes to be 7 feet 6 inches from floor; single sash hung same as fan-lights. Glass, 12 by 14, 6 lights.

Inside doors to be double faced, four panelled, and moulded with neat flush mouldings. All to have fan-lights above, two lights high and hung on pivots in centre. All doors to be hung with strong, suitable sized butt—three butts to each door—to be fastened with suitable sized locks and bolts. All to be of the best quality, properly put on where required. Glass for partitions and head-lights to be the same as the windows, put in in the best manner, complete in every part.

STAIRS.—The stairs to be put up on each side of the said building and in rear, as shown. Platforms, 10 feet wide, to extend from recess to rear of building; (upper platform on outside stairs on each side of building to be covered with a porch, supported by three columns neatly finished, with roof tinned, as on main building.) All to be put up on strong timber carriages, $1\frac{1}{2}$ -inch strings, $1\frac{1}{2}$ -inch steps, $\frac{3}{4}$ -inch risers tongued into the steps; all to be of the best quality of yellow pine. Stair risers not to be over 7 inches in height; all to be put up in the best manner with platforms, &c., as shown on plans. The railings around the platforms and stairs are all to be put up in the strongest manner possible, with strong rails and $1\frac{1}{2}$ -inch square balusters and posts, as shown on plans; also, put up a strong step-ladder from second story to roof, and a scuttle on roof placed where directed.

FLOORS AND ROOFS.—The floors to be laid with the best mill-worked yellow pine flooring, $1\frac{1}{4}$ inch thick, not over 5 inches wide, laid in courses, blind nailed, each plank to each beam, to be neatly jointed and the joints properly smoothed off when finished. All to be clear, well seasoned, and free from defects. The stoop platforms to be covered with same quality of flooring. Platforms to be furred up in height as directed.

The roofs of main building and of privies to be sheathed with common mill-worked plank $1\frac{1}{4}$ inch thick, bracketed to frame. Valleys for water-courses, and all to be well nailed down and properly prepared to receive the tin. All roofs to be covered with best quality I C tin plate, charcoal refined iron, well nailed down, well clenched and soldered, and warranted to be water-tight for one year. Put up on each corner in rear two 6-inch diameter leaders, running across the rear, conducting the water from the roof to the cistern. The tin to run up on the rear wall and return on top under the coping. Also to be returned in all chimney joints. Tin work to be properly painted two good coats, the resin to

be neatly cleaned off before painting. Paint to be of best quality roof paint, mixed with pure linseed raw oil.

HALL WARDROBES—Put up in all the hallways where directed, metal hat pins screwed on beaded slats enclosed with small slat closets as directed. The total number of hooks to be about 500. The closets also to be fitted up with shelves in a plain and substantial manner as directed.

PRIVIES.—Two double privies to be fitted up in yard, 8 by 14 feet, vaults 6 feet deep, with seats, risers, lids, &c., in the most approved manner, with 3 by 8 inch beams for floors, covered with narrow plank, $1\frac{1}{4}$ inch thick, mill worked, and covered with 3 by 6 inch rafters, sheathed with roof plank and tinned, same as building. Also, in centre of each, carry up a large stench pipe running out above the roof; and on the side of each attach a private privy for the teachers. All to be fitted up with small sashes for light, with doors, &c., complete, in the most approved manner. The floors to have a strong hatch screwed down, so it can be taken up for the purpose of cleaning the sinks. The outside walls of said privies to be built of brick, 8 inches thick.

Two WASH-ROOMS to be partitioned off and fitted up in rear basement, one for the girls, and one for the boys; also janitor's room and fuel room in front of basement, as directed, with studded partitions, and lined with tongued and grooved boards both sides, with batten doors where required, hung with strong hinges, and fastened with padlocks, hasps, and staples.

CORNICE.—Put up neat, substantial wooden cornices in front and on side of building with sawed brackets, mouldings, &c., well fastened on rough brackets; all to be finished and completed in the best manner, as shown on plans.

PAINTING.—All the wood-work, both inside and outside, which is usually painted, is to have three good coats of best quality of paint, of whatever color directed. All nail holes and slight defects in wood-work are to be neatly puttied up before painting.

VENTILATORS, SMOKE-FLUES, REGISTERS, ETC.—Put up on the roof two large galvanized iron ventilators, 20 inches diameter, to be of the most approved pattern, put up in the best manner and warranted water-tight. Smoke-flues are not to be less than 9 inches square in the clear; ventilating flues not less than 12 inches square in the clear; each flue to be carried up independently of any other flue, and to terminate in the ventilator or chimney top on the roof.

Put into the flues, where directed, stove-pipe rings and covers. Also put in the ventilation flue of each room ventilating registers, one at the top and the other at the bottom of the room. Ventilation flues must descend to the basement, and left open on outside, with adjustable doors to regulate the admission of cold air; also in the flue between the two openings in a room is to be a close fitting door hung on pivots arranged to be controlled at will from the room, to shut off currents of air when desired. The registers in rooms to be made to open or close at pleasure. All these flues to be constructed with reference to passing the foul air from the room out of the ventilators at the top of roof, and for admitting pure air in its place.

QUALITY OF MATERIALS AND WORK.—All the materials used in the construction of the building to be of the best quality of their several kinds. The wood to be well seasoned, and whenever exposed to view to be free from any objectionable defects. All of the above mentioned work to be done in a complete, thorough, workmanlike manner.

The specification and plans are intended to cover all and every part of the details necessary to complete the building in all its parts, in a plain, substantial and thorough manner, and no omission in the plans or specifications will be deemed an excuse for not fulfilling the work.

FURNITURE.

71. Furnish well. Let this be the motto whatever the character of the building may be. If costly, it will command good furniture. If plain, nearly all the advantages of an expensive house may be attained, for the time, by furnishing well. There is vastly more comfort and contentment to teacher and pupils where the wants of the school have been handsomely provided for. The result on the one hand is cheerfulness, love of school, and progress; on the other a distaste for study, truancy, and dissatisfaction. There is now and then a brilliant mind that is fired with a thirst for knowledge—such will learn under the most adverse circumstances; but this is not commonly the case. We have to win youth by making the path to knowledge a pleasant and, if possible, a flowery one. Children cannot sit still long at home. They need not be expected to preserve order at school when the arrangements are not such as to meet the plainest demands of the place and pursuit. Let those who oppose a liberal supply of furniture for the school try being pupils for a few weeks. Would they not generally yield their objections? Children grow restless and troublesome from the very agony of sitting still. The school ought not to be a reminder of the pillory or the whipping post.

72. The desks and seats may be so fashioned as to relieve this irksomeness. They will then add to the enjoyment of the children, the ease of the teacher's duties, and stimulate the pupil's progress. The height of the seat should be such as to allow the foot of the child to rest naturally on the floor. The front edge of the seat may be half an inch higher than the back, to prevent the tendency to slip forward. The height of the desk corresponds to the height of the child's body. This may be determined by raising the arm to an easy position for writing or using the slate pencil. The desk may slope toward the pupil about one inch and a half to a foot of the width of the desk. A space about three inches in width at the front edge ought to be level or sloping a little from the pupil to prevent pens and pencils rolling off. Sometimes a groove is ploughed out in which to lay them, leaving three inches for an ink well in front of it. The back of the desk ought to have about the same inclination from a vertical line as a chair back, say two inches to a foot. Where the furniture is to be made by a carpenter at home, it is often desirable to make all the joints square. In that case the desk, seat, and back may be set at right angles. To get the slope for the back, and the inclination for the desk, cut the foot of the standard on a bevel of one inch and a half to the foot.

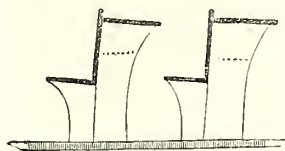


Fig. 29. End view of common wooden desks.

The cut represents the ends of wooden desks as commonly made by carpenters. The material used is pine boards. They are much better than no desks; but there are grave objections to them. The ends or standards are two feet broad on the floor. The great width interferes with pupils getting in and out of their seats. Dirt accumulates about them and cannot be readily swept or scrubbed away, especially on the inner sides. Uneasy children unconsciously thump their shoes against them, causing confusion in the room. The backs are boarded down low, which with the ends prevent a free circulation of air. The nails work loose in the standards or draw out of the floor and leave the desks in a rickety condition, quite unfit for use.

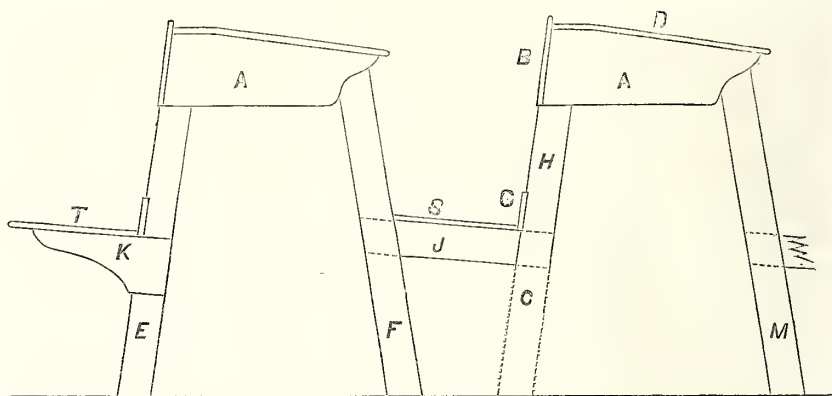


Fig. 30. End view of improved wooden desks and seats.

73. A A represent the ends of two desks; E and C, the long standards; and H, a short standard at the front. F and H are at the centre of the desks; J is a cross-bar halved into F and H, and bolted to them. It holds the two desks firmly together, so that any motion of pupils sitting on the seat S would not jar the desk at the back of them. An entire row of desks locked together in this way are much firmer than when they stand independently.

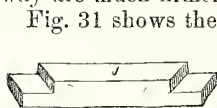


Fig. 31. Cross-bar.

Fig. 31 shows the form of the cross-bar J, and the points at which it is interlocked with the standards F and H. It is attached to them with small bolts or large screws. S and T represent the seats, which are 12 inches wide; B and G form the back to the seat. They are halved into the standards and securely fastened by screws; G is also nailed to the back edge of the seat S, which is supported in the centre by the cross-bar J. Each end of a seat is supported by a bracket as shown at K. This bracket is omitted under the seat at S in order to show the cross-bar.

The standards and brackets are of hard wood. The former are about 3 by 3 inches square. Their appearance may be improved by turning the parts not covered by the other portions of the desk which are attached to them. The brackets are an inch or more in thickness, halved into the standards. In putting together, the joints should all be glued and bolted or screwed firmly to each other. The feet of the standards are fastened to the floor by cast-iron braces or knees. Each desk is furnished with a shelf divided into two compartments, one for each pupil. An iron brace six or eight inches long runs down from the shelf to each side of the long centre standards F and M.

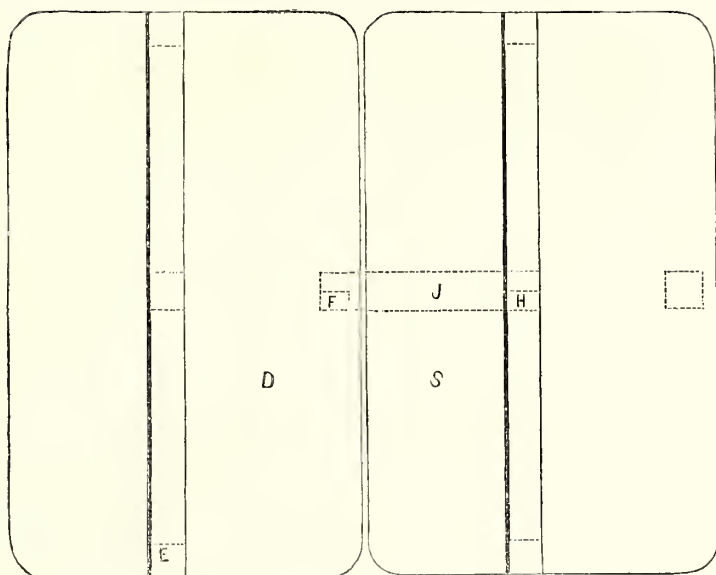


Fig. 32. Tops of desks and seats, showing form, size, &c.

In this cut D represents the tops of the desks, and S S the seats. J, the cross-bar, with its connections at the centre standards F and H. E and its corresponding points give the position of the tops of the end standards. Over the short standards at H and I a hole is made for an ink-well, of which a cut and description are given below.

The end standards present even less hindrance to persons getting in and out their seats than iron standards. The children cannot hit their feet against them, except by an effort and desire to create confusion. There is no lodgement for dirt that may not be readily reached by broom and scrubbing brush. The heights of the standards may be altered to conform to the sizes of the smaller pupils, as given in the Scale of Measurement of Desks. (§ 75.) The air is allowed free circulation. An entire row is locked together in such a manner as to be self-supporting and to resist the jarring incident to the pupils moving on their seats, or pressing their backs against the desks behind them.

Iron standards for desks and chairs are among the expensive luxuries and conveniences to be aspired after as the work of improvement goes on. They accompany finely polished tops, easy and comfortable chairs. They are represented in annexed cuts.

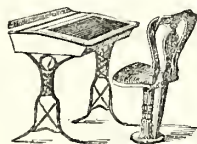


Fig. 33. Single desk and chair.

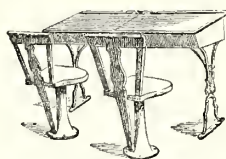


Fig. 34. Double desk and chairs.

74. TO LAY OFF THE FLOOR of a room, for putting down the furniture, strike a chalk line along one side three and a half feet from the wall. This marks the width of an aisle, also the side of a row of desks. Measure off the length of a desk, and strike another line parallel with the first. Lay off the width of an inside aisle next, then of a row of desks, and so on until there remains only space enough for the other outside aisle three and a half feet wide.

Now begin at the back end of the room. Draw a line across it three and a half feet from the wall. This gives the position for the standards of a range of seats. Put them in their places. Set up a desk so that the edge next the pupil will fall less than half an inch short of the vertical line touching the front edge of the seat. The space which a desk and seat occupy in a row is now obtained; with it lay off other cross lines denoting the positions of the rest of the desks.

The larger desks stand at the back end of the room. Two, three, or four different heights will be required. They need not vary in length. Six inches is allowed for the width of the seat standards and the slope of the backs when commencing to lay off at the back side of the room. Before beginning to put down the desks it will be found very convenient to make for use what the carpenters call a "bevel." This is formed by two strips of board three to five inches wide and two feet long, nailed together at the same angle represented by one of the end standards with the floor, say an inch and a half to the foot.

75. SCALE OF MEASUREMENT OF DESKS AND SEATS.

Size.	DESK.		SEAT.		Length of desk and seat.
	Width.	Height of edge from floor.	Width.	Height of edge from floor.	
	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
No. 1.....	18	27½	12	16	48
No. 2.....	16	24½	11	13½	46
No. 3.....	14	21½	10½	11	44
No. 4.....	12	20	10	10	42

76. INK-WELLS.—The waste of ink and the destruction of clothes by accidents in a school during any single year has been computed to be greater than the cost of furnishing every desk with a permanently attached ink-well. The ink-cup, represented in Fig. 35, is a common form used for this purpose. It is fitted to the desk by boring first to the depth of a quarter of an inch with an auger the size of the flange, then with one of lesser size deep enough to receive the entire cup. The position of the ink-well for a double desk is in the centre of the level space at the top, so that the two pupils occupying the desk may use it jointly.

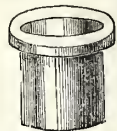


Fig. 35. Ink-cup.

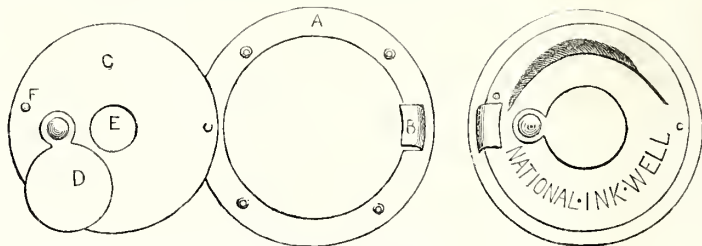


Fig. 36. Cover for Ink-well.

A is a metallic ring fastened to the desk; B, flange raised to receive C (the cover) when turned and pressed under the flange, which holds it tightly; D, the cap with which to close the pen hole E, and prevent evaporation.

Some simple contrivance is needed to cover the ink-cup, for the double purpose of preventing the pupils from taking the cup out at any time, and to guard against evaporation. These objects are gained in the illustration.

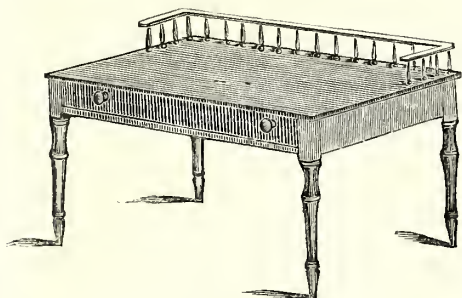


Fig. 37. Teacher's table, No. 1.

77. TEACHER'S TABLE.—Fig. 37 represents an approved style of plain table for the teacher, adapted to the wants of a small school where there is a teacher's room or closet.

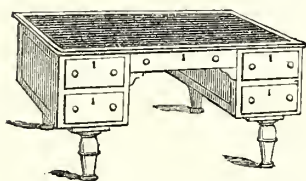


Fig. 38. Teacher's table, No. 2.

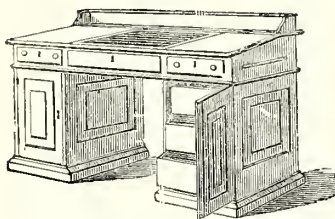


Fig. 39. Teacher's table, No. 3.

Where those conveniences are not provided, larger tables, like those shown in Figs. 38 and 39, are needed for the safe-keeping of books, papers, &c., of various kinds required for daily use in the school.

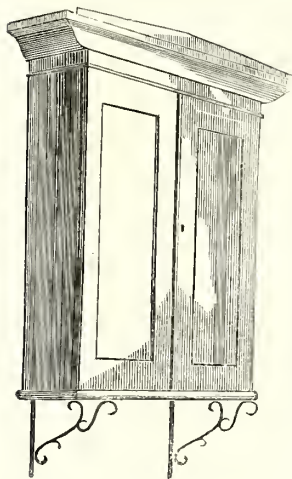


Fig. 40. A Book-case.

78. The furniture of the teacher's room should comprise two or more chairs, a small writing table, a book-case for library, and a closet. When enlarged to adapt it to a recitation room, seats and blackboards will be required.

We would recommend, instead of the brackets shown in the figure to support the book-case, a suit of large drawers extending down to the floor for wall maps, charts, &c.

79. BLACKBOARDS are indispensable. With them a well qualified teacher can instruct a large class with the same facility as one pupil. The illustrations given on them arrest the attention of children and help to enforce a truth or an explanation. Pupils are fond of working at them in classes. Especially are they important in the instruction of primary scholars. Fifty children may be taught the alphabet and easy reading, as well as the elements of writing, drawing, and arithmetic, sooner and easier with blackboards than fifteen can without them.

Their supply should be abundant. Beginning with a fine large one on the wall in rear of the teacher's platform, they should extend to the two sides of the room, covering the vacant spaces between the windows. The upper edge should not be over six and a half feet from the floor. The lower one should come to

within two feet of the floor, making the width about four or four and a half feet. At the lower edge, a trough four inches wide is needed for the chalk, rubbers, and pointers. The other three edges may be bordered by a plain moulding.

80. The material for blackboard is white pine, white wood, or other similar grained wood. Yellow pine and some of the hard woods have a coarser and unequal grain, that make them unfit for this purpose. The stuff should be an inch to an inch and a half thick, thoroughly seasoned, planed smoothly, sand-papered down, and set in a frame at the ends so that they may be crowded together in case of shrinking.

81. BLACKBOARD PAINT.—In color, it should be dark, nearly black. It must be durable as the hardest varnish, yet not glossy. Its surface should be slightly gritty, so as to catch every touch of the crayon, without being harsh or rough. The oil paints become smooth and glossy with wear; to prevent this, add a small quantity of the finest flour of emery or pumice-stone before using. A few experiments may be necessary to determine the quantity.

A most excellent article is sold by the school furnishing houses. A fair imitation may be produced by dissolving gum shellac in alcohol. This gives "body." Add flour of emery to produce an abrading surface, and lamp-black, moistened with alcohol, to give the color. The liquid should be thinner than paint and constantly stirred while being applied. A fine hair brush should be used to put it on with; common paint brushes leave the surface rough. To smooth it down take a block of wood that has been coated with the same material, after both are dry and hard, and rub it over the face of the board.

82. PLASTER BLACK WALL.*—The following directions may be of some use in making plaster black wall:

In the first place, the scratch coat, made with coarse sand, is spread upon the laths as usual, and the brown coat follows, being left a little rough under the "float." When the brown coat is perfectly dry, the black coat is laid on.

This is prepared of mason's "putty" and ground plaster and beach sand, mixed in the usual proportions for hard finish. The coloring matter is lamp-black, wet with alcohol or whiskey, forming a mixture of the consistency of paste. This is mixed with the other ingredients just as they are about to be spread upon the wall. The quantity of coloring to be used must be sufficient to make a black surface; *the sufficiency being determined by experiment*—no rule can be given. An intelligent mason can very soon try experiments so as to insure success. It is to be remembered that the black surface requires much more working with the smoothing trowel than ordinary white finish. It should be finished by being softly smoothed with a wet brush. When perfectly dry it is nearly as hard as slate, and almost as durable, if carefully used. Great care should be taken not to put in *too much* lamp-black.

The following recipe is suggestive:

For twenty square yards of wall, take three pecks of mason's putty, (white finish,) three pecks of clean, white sand, and three pecks of ground and calcined plaster; add to this mixture three pounds of lamp-black dissolved in three gallons of alcohol, and lay it on evenly and smoothly.

A mason who has had good success in this class of work uses one part hydraulic cement with two of lime in the second coat. The lamp-black is used in this and no skim coat is added. So much depends upon the nature and conditions of the materials employed that it must be left to the experimenter to make the exact combinations in each particular case.

83. A paper surface that answers well on walls too rough for the chalk or crayon, may be made by taking the stout manilla paper that comes in rolls; cut it the required length; lay it on a table and moisten it with a preparation of glue

* Barnard's School Architecture.

or paste. The wall should be first smoothed down with a piece of pumice stone or a brick, and covered with a coating of glue. Apply the paper. When dry use the best paint that you can get for it. Renew the paint as often as it seems necessary, for the paper itself would soon wear through if left exposed to the abrasion of the chalk.

84. SLATE makes the best blackboard. It is indeed the only thing really fit. All the others are temporary substitutes, cheaper in the beginning, but infinitely poorer and finally more costly. They may be ordered through the school furnishing establishments, or obtained at the Eagle quarries, Vermont, of any required size. They are three-fourths of an inch thick; never get out of repair; will last for generations. It will always pay to get them where there are several rooms to be furnished.

85. RUBBER.—"The best thing for removing the chalk from the board is a brush, made of the size of a shoe-brush, with the wooden handle on the back, the face being covered with a sheep-skin with the wool on. This removes the chalk at a single sweep, without wearing the surface, and without soiling the hand of the operator. This is a great improvement over a dust-cloth or a sponge."

86. KEEP DRY.—"In all cases let the board be kept dry; never allow a pupil to wet the wiper when removing the chalk."

TO RESTORE THE SURFACE.—"By long use, especially if the surface is ever cleaned with a wet wiper, this kind of blackboard becomes too smooth and glossy upon the surface; the chalk passes over it without taking effect, and the light is reflected by it. A very simple wash, applied with a soft brush, will immediately restore it; this wash is made by dissolving one part of glue, to two parts of alum in water, so as to make a very thin solution. It is well to have the wash slightly colored with lamp-black. Care must be taken that this wash do not have too much 'body.'" [Barnard's School Architecture.]

87. We are not yet done furnishing the school-room. There remains to be supplied a variety of lesser articles. To name them will generally suggest their use and importance. As accompaniments of the fireplace or stove, a poker, shovel, and tongs, a sheet-iron ash pail, and a dish for evaporating water, are needed. A broom, dust-brush, and dust-pan, mop and mop-pail, scrubbing-brush, wash-basin, and towels, two water-buckets and dippers, door mats and scrapers—all familiar and suggestive names, bringing to mind white floors, clean furniture and sweet faces. A clock, thermometer, and signal-bell for the teacher will help to insure promptness, regularity, comfort, and good order.

88. A large bell should ring out the hour for school from the belfry, loud enough to be heard all over the village or district. If grown-up persons must be reminded of the return of the hour of prayer when the welcome duties of the sanctuary are to bring consolation and repose from care, how much more do children in the midst of their glee and innocent amusement need to be admonished that school time is at hand.

By all that we love in youth or hope from them in riper years, let the school-building be good, the furniture better, and the teacher the best that our means can obtain.

OUTBUILDINGS.

89. A WOOD-HOUSE is always needed. A shed for the wood can easily be built when a better building cannot be prepared. Then the wood can be procured months in advance of cold weather, cut up, piled and be in readiness for use. The habit of using green wood is a wasteful one. It takes more wood; the steam generated cracks the stove and rusts the pipes. The temperature cannot be properly regulated with it. The gases which it emits are often offensive and injurious to health. And then, it is an unreasonable tax on the teacher to add the task of seasoning the fuel to conducting the school.

90. AN ASH-HOUSE is needed also. It is a slovenly practice to throw the ashes down by the door to be tracked back into the house again.

91. PRIVIES.—It is said that the objection which many parents, and especially mothers, have to sending their daughters to the public school arises from the disgraceful condition of the back-yards, and the utter neglect of enforcing the decencies of life. In the first place, there should be two separate privies, not within a hundred feet of the well or the house, nor near each other. A tight, high board fence or evergreen hedge should divide the back-yards. Lattice screens overgrown with vines or evergreen hedges should add to their retirement. They should be large and supplied with vaults not less than six feet deep, through which, if possible, a stream of water should pass. In that for the boys there should be an arrangement to prevent their standing on the seats. Let urinals be provided on one side of a partition and seats on the other. Subdivide them by short partitions so as to allow about two feet to each division. The whole should be painted and heavily sanded to prevent marking. The doors should be kept locked and no one permitted to enter except during the hours when pupils are allowed in the yards. The teacher, out of respect to common decency, will see that nothing in connection with the establishment becomes a disgrace to the school nor a nuisance to the neighborhood; but the school officers will not neglect their share of the duty, by having the vaults cleaned and supplied with lime, wood-ashes, and other strong disinfectants during the hot season. This must be rigidly attended to by the janitor, in large buildings. For specifications for the construction of privies see ¶ 70. Wood may, of course, be substituted for the walls above ground in the place of brick.

IMPROVING THE GROUNDS.

92. If there were any point at which a digression from the rigid line of practical thought were admissible, it is here. The school has a character to establish. It is to be honored and cherished, or neglected and despised. To be honored it must be fruitful in good works. Yet of itself it can do nothing. It has neither personality nor power, except as its friends impart vitality to it. It is to be the reflection of their wisdom and care, or the memorial of their ignorance and impotence. The erection of a fine building is one good step; furnishing it well, another; employing a good teacher is not the least item. But beyond these the improvement of the yard and grounds is worthy of much attention. Children catch the sentiment of a place as by inspiration. The beautiful lawn, the shady grove, the inviting play-ground, have a charm for them. Even the flower border impresses rough and reckless fellows with respect. It helps to refine their thoughts and purify their hearts.

What shall the improvements be, and how shall they be made? The circumstances of each case must be regarded. We only suggest in a general way.

93. FENCES.—One of the first things to be done in this line is to enclose the grounds with a substantial defence against the incursions of stock allowed to roam at large. A good panel board fence need only be named. Every one knows how to build it. If sawed lumber be scarce a fence of posts and rails is not to be despised. Where rock is easily obtained and the ground is firm, a stone wall answers every purpose. If the material be nicely selected and well laid, there is no particular objection to this sort of enclosure, except that the top stones will be liable to get knocked down by the boys in their plays. Vines may be planted to run over the wall. The woodbine, the ivy, grape, clematis, or any of the numerous delicate flowering vines with which a neighborhood abounds, would add much to the grace of an otherwise uncomely fence.

94. Gates or wickets of the most substantial kind should be placed at the entrances. There may properly be one in front and one for each of the yards, besides a large gate for teams when hauling wood, &c. Some neat, strong speci-

mens of rustic gates are illustrated in several cuts in a subsequent portion of the work.

95. In the construction of walks, such materials may be used as are commonly employed in the neighborhood. When gravel is abundant there is nothing better. It should be liberally spread around the front of the building several inches deep. If the ground be moist let blind drains be laid under or near them and in the direction of the gates, out-buildings, well or spring, and the play-grounds. They may often be gracefully curved and in that way improve the appearance of the yard; yet if the curvatures are too great the children will leave them and run across the grass.

Plank makes a good substitute for gravel, but are rather expensive. Permanent walks are also made by mixing plastering-sand with boiled coal tar in such proportions as to form a stiff mortar, and then spreading on a coating two inches thick. For drive-ways or road-crossings it must be much thicker.

96. SHADE AND ORNAMENTAL TREES—Under this head much might be said: the kinds to be selected, the time of year to transplant them, where to set them, and how to tend them afterwards—all this must be left to the local officers or friends interested. The entire plat should be surrounded by a row of shade trees planted twenty to thirty or more feet apart, according to the habit of the tree. Selections may be made from among the broad spreading oaks, the graceful elms, the pretty-leaved maples, gums, ashes, locusts, and their kindred, or the unique juniper, arbor vitæ, the spruces, firs, pines, cypress, and other cone-bearing trees. Within the yard the magnolia, the palmetto and its kindred, the oleander, the flowering myrtle, the orange, date, olive, and many other elegant and attractive trees. Shrubs and flowering plants should be carefully planted.

All that need be done in this direction may be accomplished without paying out much money. There are many wild flowers which equal or excel the cultivated varieties, which the children might bring, with all their roots undisturbed in the earth, from their native habitats. The older boys can dig up the trees under the instructions of an experienced tree-planter, who will teach them how precious are the rootlets to the life of the tree, and how carefully they must be preserved from dryness or bruising. Let some one start the project, volunteer his own services, bring in others, and the work is done. But that some one must take the lead. Talk is idle. Work wins. Those who do the work will have the credit and the satisfaction.

97. DRAINAGE should be complete from every part of the grounds. Where the soil is not sandy or gravelly, and especially where the sub-soil is compact, some artificial drains will be needed to carry the water off as fast as it falls on the surface. Surface or open drains are useful, but not sufficient in many cases.

A secret or blind drain should be sunk every twenty to fifty feet, according to the soil, running in the direction of the declivity of the ground. Its width on the bottom will vary with the kind of drain laid. If tile, made of burnt clay, it may be narrow, only wide enough for the ditcher's foot. If stones are used, it must be wider, say twelve to sixteen inches, according to the size of the stones.

To make an arched drain lay a course of stones four-inch square along each side, cover these with a flat stone wide enough to lap on to each side at least two inches. Fill in with smaller stones, say six inches. Then scatter in a course of straw, broom grass, or other litter, three inches. Haul in the dirt, pounding it down firmly as you go.

Cobble stones, three-inch diameter, or less, may be used when square and flat stones cannot be obtained. They are thrown into the ditch to the depth of six or twelve inches, then covered with straw, or sods turned grass side down, and filled over with dirt.

Where stones do not abound logs may be used. Take three sticks of straight, enduring timber six to eight inches in diameter. Lay two for the sides, and a

third, which should be larger and might be split in two, over these, then fill in as before.

When a portion of the soil is spongy, or sandy and springy, common drains are liable to fill up. In such cases brush may be used. Gather a quantity of small straight limbs from some trees noted for enduring well when exposed to dampness. Commence with these at the higher end of the drain. Lay the fine brush towards the higher end, the larger ends of the brush going down into the bottom of the ditch. Place one course on after another in a shingling fashion. Cover as before directed.

Another style, known as the box drain, is available for general drainage, but especially adapted to carrying water from leaders, wash-rooms, &c.

The bottom plank of a box drain is two inches thick by six or eight inches wide; the side pieces two or three inches square; the top same dimensions as bottom. When used specially for drainage, holes may be bored through the top and sides. Notches cut in the side pieces before putting together answer the same purpose. They are more quickly made. The object of these perforations is to let in the water. A box of rough materials could scarcely be so tight as to keep it out. If in the ground it will find the passage.

Drains should be laid under or near walks, and generally at all places where the water stands after a shower.

HOMES FOR THE PEOPLE.

98. Good schools and good homes must unite in the elevation of any people. The one opens the mind to a knowledge of the world we live in; the other softens the heart, refines by its gentle influences, the rude passions and trains them into control. When the child passes from the tender care of a dutiful, Christian teacher to a hovel of filth, where the decencies of life are disregarded, the contact is contaminating. The aspirations implanted in the youthful mind after a higher life are weakened or wholly eradicated. Not alone is "the destruction of the poor their poverty," but ignorance paralyzes their efforts and neglect chills many a noble young heart. The love of home is God-given. It rises instinctively in youth. Never was there a boy born in hunter's cabin or royal palace but pictured to himself the happy home he would have some day of his own. And yet how many generous spirited boys for the want of such a home have grown up to a hard, coarse manhood, or dwindled into maturity full of sharp, scheming, tight-fisted selfishness, sinking at last into an unloved and pitiable old age.

It is a misfortune for persons of small means, without stated and regular incomes, to be obliged to bring up their families in great cities. Business can pay higher rents than homes, so it drives homes out to the suburbs. But the poor, for the sake of being near their daily labor, often crowd into vast tenement houses which are wholly unfit for habitation, or take refuge down filthy alleys in damp, dismal cellars. There the pure air and sunshine can seldom come. Vice, ignorance, and immorality conspire together to destroy the health and ruin the soul. But little better is it for those who colonize upon the outskirts on low, damp, marshy lands liable to overflow by fresh water. The air of such localities, poisoned by the miasma which they generate, invites the annual recurrence of fevers and the attacks of wide-spread and fatal epidemics.

99. As a rule, the man is a better, more stable citizen who owns a home of his own. That house, though it be only an humble cabin, is his castle. There the laws protect him in his rights, and he bids defiance to any intruder. The American policy, recognizing the mutual relations and dependency of an independent yeomanry to a free government, invites the homeless of all nations to come and take the gift of a farm, to own it, live on it, cultivate it, and become a responsible member of a liberal and powerful nation. To promote intelligence it dispenses millions of acres under a pledge that they shall be sacredly devoted

to educational uses. There is not only land enough for every man to have a farm, but material enough for every family to have a comfortable home.

100. In seeking a location the first consideration is to learn whether it is healthful. No one giving the subject thought will locate where his family will be exposed to the "effluvia of vaults, drains, sewers, and extensive piggeries, slaughter-houses, manufactories of manures from bones and other putrescent emanations. These are prolific sources of disease, almost always with a typhoid tendency." The house should stand where there will be a free play of breezes, yet sheltered from the rudest winds. Trees should be near, yet not so near as to shade the house completely, or shut out the gentle breezes in hot weather. Both these and the sunlight are essential to health. The employer who would make his own interests to be respected by those he employs, will extend all the aid he can in helping them to secure pleasant, comfortable homes of their own.

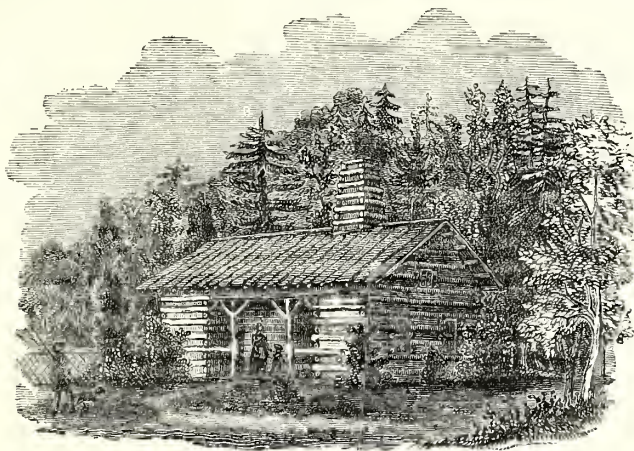


Fig. 41. Design for Log House.

101. Our ideas of log houses are almost always associated with pioneer life in a wooded country. But this does not necessarily connect them with poverty, much less with ignorance and vice. Pioneers are often the most far-seeing, stout-hearted, and industrious of men, given to frankness and an open-handed hospitality that regales their guests more than a feast. In presenting, therefore, a unique design of this kind we prefer to conceive that it is to be copied by intelligent, thrifty people, who will soon reduce the forest to a fruitful field, and build school-houses and churches where lately the wildness of nature ruled supreme.

The architect (Vaux) justly remarks: This design does not illustrate a log cabin, or single room, in which a family of men, women, and children eat, drink, sleep, wash, dress, and undress all together. It is the plan of a house for a well-to-do settler and his family.

The principal apartment, sixteen by twenty feet, is proposed to communicate at once with the open air through a door under the veranda-porch in the summer, and to be approached through a small wash-room at the side in the winter. The veranda may then be used for storing a small supply of dry wood under cover. In the wash-room is a flight of ladder steps leading to the loft. The family room has two windows in it, and is connected with two small bedrooms and a store-room, each supplied with one small window. The house is intended to be constructed in the ordinary manner with rough logs; but as much neatness as is compatible with

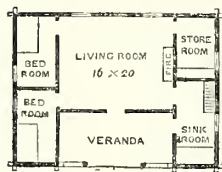


Fig. 42. Plan of Log House.

proper economy is supposed to be exercised in the selection of the material and in the execution of the work. In clearing up the forest a little judicious forethought will certainly preserve a few fine specimens of the primitive growth around the family home for shade and enjoyment.

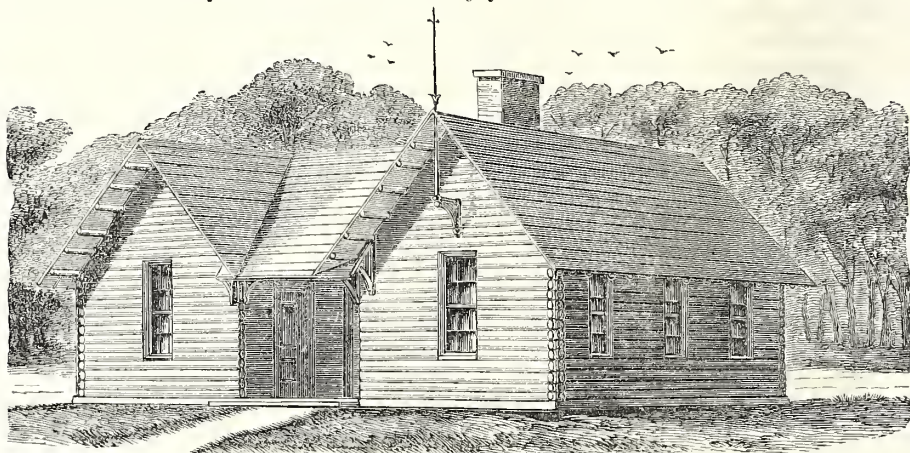


Fig. 43. Design for a Saddle-back Log House.

102. Even after saw-mills have become common, where the lumber must be hauled several miles over bad roads, it is better economy to use these primitive materials than resort to boards, for little or no reason, except that other people live in houses constructed of sawed lumber. Our architect, Littell, has given us an enlarged design for a log house, with rooms for the accommodation of a good-sized family. Its construction is that of a block-house—that is, the timbers are hewn or squared, and laid up snugly and strongly one above the other with great care and neatness. The size and arrangement of the windows and doors, the construction of the roof and of all other parts, will suggest themselves to the workman who is familiar with building this class of houses. Useful hints may be gleaned from the general directions contained in ¶ 48, on the construction of a log school-house.

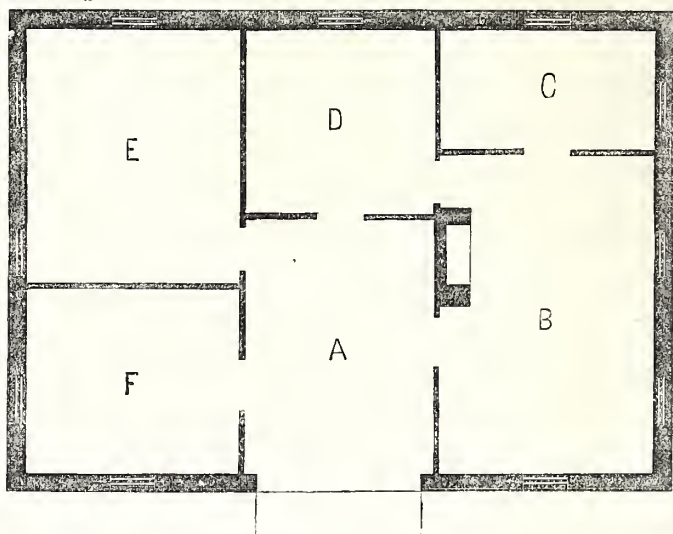


Fig. 44. Plan of Saddle-back House.

From the porch A, which is large and spacious, communication is had with all the rooms. On the right is the principal living room B, 26 by 18 feet, with a fireplace. It communicates with a large pantry C, 9 by 18 feet, and with a commodious sitting-room D, 15 by 16 feet. On the left we have two large bed-rooms, E, 18 by 21, and F, 15 by 18 feet. The arrangement is quite simple and subject to modifications to suit the taste or wants of occupants. For instance, the pantry might be divided, forming also a clothes press to be furnished with shelves. The two bed-rooms on the left would not suffer by subdivision into three if the wants of the family required. But we must not carry the subdivision too far, lest we shut off the light or air from some of the apartments, and thus entail more evils than we gain advantages.

In houses like these some of our most active and energetic men have been reared. Their careful and intelligent parents sent them into the world with sound constitutions, good morals, and a fair share of good sense. Their education was begun at the fireside, or, more literally, by the light of a "fat pine knot" in the chimney corner, by which they have been enabled to grasp the ideas of the age and to make themselves useful, working members of a great and prosperous people. Men who now hold the highest positions in the gift of the nation first learned to contend with and conquer difficulties while living in log houses, even less respectable in appearance and far less comfortable than these illustrations show. We would not addle any young man's brain with the thought that he too may yet be congressman, or senator, or chief justice, or President, though he might have been born in a log cabin; but we would that every one might strongly feel there is an honorable and useful place for him in life, that the want for good, honest, upright men was never greater, and that any one who will prepare himself well to fill the place of a man, and go to work with a manly judgment and persistence to fill it, may rise to that sphere in which his talents and taste will find full and satisfying exercise.

The style of building shown in the perspective elevation is well adapted to school-houses requiring two rooms.

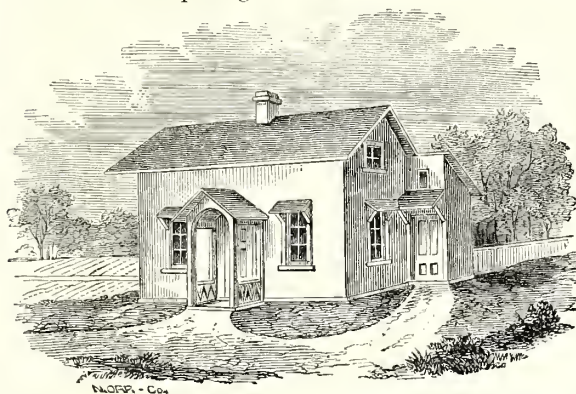


Fig. 45. Design for a Laborer's Cottage.*

The side elevation gives a view of the lean-to in the rear, showing a continuous roof, one-quarter pitch—that is, one foot perpendicular rise to each four feet

103. The engraving presents a perspective view of a cottage constructed after the style of a box frame, described in ¶ 49. The roof projects about 2 feet. The windows are hooded in the plainest manner. The stoop, 6 by 4 feet, will protect the front door from the storms. It is broad enough for a seat on either side, and is an inviting place for father and family, after the day's duties are done.

* This and the three following designs, also the designs for rustic gates, are from the American Agriculturist.

across the building. In localities where there is a tendency to dampness, the elevation should be increased to one foot for every three. If the roof be too flat it harbors moss and sooner decays. The space in the garret is so small as to be scarcely worthy of notice. The window serves to ventilate it. No one should sleep in the confined air of such a close place as it would be with the windows shut in hot weather. Nor would it be much better in the cooler nights unless they were opened. The ceiling of first story is ten feet high. To make the second story habitable the walls should be carried up four feet above the floor. Of course a full height is preferable.

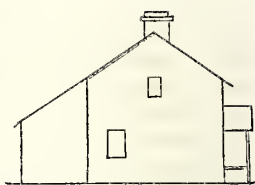


Fig. 46. End elevation.

The arrangement of the rooms in the ground plan is not complete. The living room, L R, is 14 by 14 feet; bed-room, B R, 8 by 8 feet. Back of this the room C is 8 feet long, with a passage by the side of a stairway of $3\frac{1}{2}$ feet. This may be used for a closet. The lean-to, marked W H in the plan, is 26 by 8 feet. It may be divided into a wash-room on the right, which would also serve for a cook-room, and on the left for a large bed-room. We have then, practically, a kitchen and bedroom in the lean-to; in the main part a comfortable living room, a bed-room and closet, or clothes press, with shelves and hooks, adapted to a variety of wants. The house, though small, would not cost as much as an active man should earn in one year, yet it has rooms enough for a small family to "begin the world" in, and, if their dis-

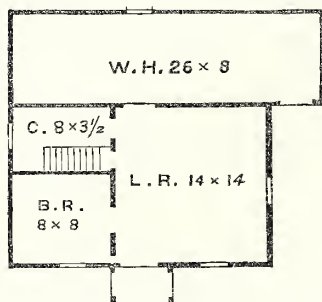


Fig. 47. Ground Plan.

positions be right, they will find much enjoyment within its walls.

It must be confessed that our new house is not quite so inviting in its external appearance as it will be after a few years have passed. The ground for the garden on the left is but just broken, and lies in ridges as the plough laid the furrows. That will be the vegetable garden, to be kept clean of weeds. The wife will plant seeds of climbing vines by the windows; the boys will set the woodbine or clematis by the stoop, and the father will not forget a trellis for grapes, a border for flowers, nor omit planting such trees as will bear fruit needed by the family. Others more purely ornamental may be allowed their share of space in the front yard. The road side may be improved by setting those of a wide-spreading habit of growth, or such as will stand for ages towering towards the sky.

There are thousands of families living on the broad prairies of the West, whose pioneer cabins were smaller and poorer than this. When they erected them not a sod had ever been broken in the broad green fields around them. They were honest, industrious, and frugal people. They were hopeful, too, and courageous. Generally those who took good care of themselves were healthy. They worked hard; others came and settled near them. They established schools and built churches. Railroads came to them. The outer world wanted all they could produce, and paid them for their labors. Now many of these families are enjoying comfort and even wealth. All this may be repeated elsewhere. Those who would reap the blessings must make the start with a right strong determination to work and succeed.

This cottage is constructed on the box-frame plan. Directions for building are contained in ¶ 49.

Bill of materials and work.

	Feet.
Sills, 6 by 8 inches, 120 feet long	480
Plates, 3 by 6 inches, 120 feet long	180
Partitions, 3 by 4 inches, 140 feet long	140
Floor timbers, 22 pieces, 3 by 8 inches, 14 feet long	616
Rafters, 3 by 4 inches	360
Roof boards	650
Siding, surface measure	1,750
Flooring, surface measure, 600, ($\frac{1}{4}$ added,) 150	750
Boards for finishing	1,000
Total	5,926

Shingles	6,000
Windows	7
Doors	6
Nails, kegs	6
Brick, (8 by 4 by 2 inches)	350
Carpenters' work, days	60
Masons' work, days	5

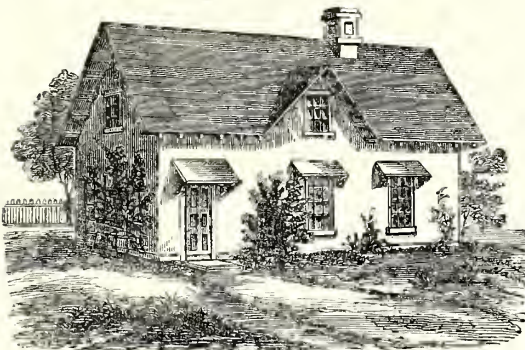


Fig. 48. Design for a Neat Cottage.

104. In this design the architect has favored us with a neat and substantial cottage. Its external appearance bespeaks good words for the dwellers within. The gable over the centre window not only gives room for a window in the attic through which light and air find admission, but it improves the appearance of the building by breaking up the sameness of the long, plain roof. Here we have the chimney near the centre, but the builder is at

liberty to exercise his preference in this as in all other matters.

The living room or sitting room L, 13 by 17 feet, serves as a kitchen. A bed room B, 10 by 12, with two windows, opens from it. Out of this a clothes-press C. The pantry P, 5 by 7 feet, is convenient to the fireplace stove. C C is a fine large closet with shelves and drawers. Opposite is a back entry with a sink S. A small window directly over the sink lights it. A cellar is provided for in the plan. The stairs to it go down from the back entry underneath the chamber stairs. The latter ascend from the hall in front and may be shut off from observation by a close partition and a door, or nicely fitted stair rail.

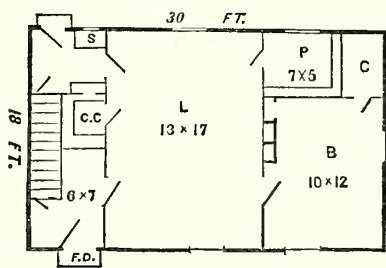


Fig. 49. Ground Plan.

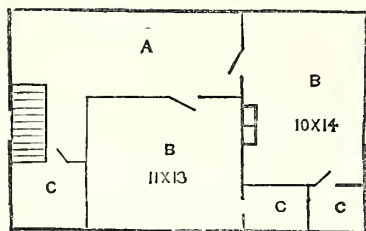


Fig. 50. Attic Plan.

At the head of the stairs we have a long narrow room, rather low, opening into two bed-rooms B B, 10 by 11 and 10 by 14 feet respectively. Each of these have a convenient clothes-press C C. Over the front hall is a small room C, almost large enough to place a bed in. It will serve as a store-room for articles that may not be needed for a time, but which are to be carefully laid away until needed.

In a small dwelling like this it may appear, at first glance, a waste of room and an unnecessary expense to have a front and back entry. This is not the case. The reverse is true. The front entry is for neatness; the other for constant use. There is no reason why the dirt which is liable to be tracked in should deface the hall through which guests would pass. The wife who attends to her own household work may, and should have quite as much pride as though several servants were at her bidding, and the husband who appreciates the weight of care and toil which falls to the lot of his wife, will take delight in arranging his house with especial regard to her convenience and comfort.

The cut shows a very plain style of hood for window. It may be made of 2 inch plank. A piazza along the whole front would be a great improvement, and would do away with the need of the hoods.

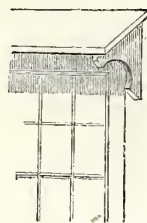


Fig. 51. A Hooded Window.

The bill of materials for this cottage is nearly the same as that for the next succeeding design.

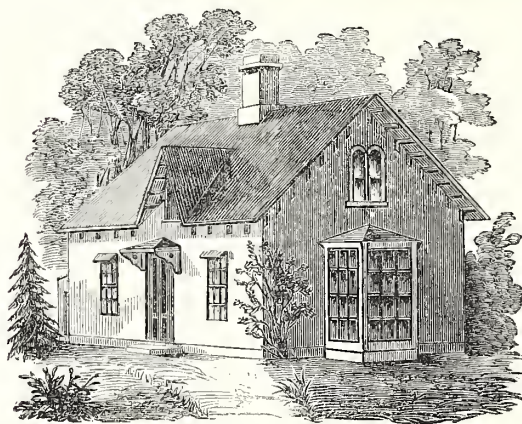


Fig. 52. Design for a Snug Cottage.

105. This design is for a small family in moderate circumstances, who have means to live in a comfortable manner, and who may expend something more on their house at the outset.

The main part is 25 by 18 feet, with an addition at the end of 16 by 5 feet, making the ground plan about 30 by 18 feet.

The principal rooms on the first floor are the living room P, 13 by 15 feet, and the kitchen K, 10 by 13 feet. They connect with each other and with the front entry, which is 4 by 11 feet. The kitchen

also opens into the side entry E, 5 by 5 feet. Off it is a sink-room, 5 by 5 feet. This opens into a pantry P, 5 by 4 feet, fitted up with shelves on three sides.

There is a cellar under the house. It is entered by a stairway out of the front hall, convenient to the kitchen. The cellar stairs are underneath those by which we ascend to the second floor. There will need be a turn in each flight of stairs. Those for the cellar should have a broad landing making them easier of descent. A closet for dishes, C C, stands by the side of the chimney. It opens into the dining room with a door, and connects with the kitchen by a slide. The living room is made much more cheerful by its bay window. It is formed of three sash set in framework and covered with a roof.

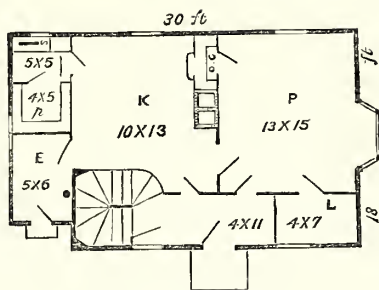


Fig. 53. Ground Plan.

The small room in the corner, L, 7 by 4 feet, is for a library. It should be furnished with shelves for books, a cabinet for minerals, shells, and other curiosities. There may be room in it for a small writing table or secretary, with drawers for writing materials. The window in the library should be narrow, say two feet wide; also the one in the hall. They may make up in height what they lack in width. In some situations the library and stairs may be changed to the opposite side of the house and the porch extended along the front of the house, as represented in Fig. 59.

We may seem to have presumed too far in setting apart a room for a library. By a family of some taste and culture it will be highly prized. This is the ultimate end to which we look forward with much hope for all. If our occupants have not climbed up so far it is hoped they will yet seek those intellectual pursuits which tend to pass them gently down the declivity of life.

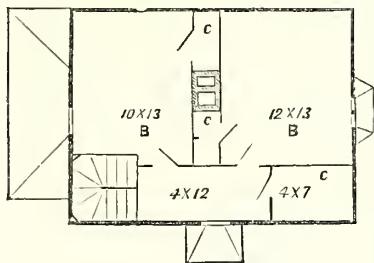


Fig. 54. Second story.

The upper story has two bed-rooms, each the size of the room underneath it. Each is lighted by a window in the end. Both open from the hall, which has a window in it. The room on the left has a small closet. That on the right enjoys a large clothes-press, directly over the library.

106. The conveniences of this cottage are not a few, yet substantial advantage may be gained by raising the walls higher than are represented in the elevation. It must be apparent that the upper ceilings would be low, and that there will be a want of light and air in the sleeping rooms. Raise the second story to the height of 8 or 10 feet and gain a window in the back side of each of the bed-rooms. How much more airy they would be! Or raise this story but 4 or 5 feet; preserve the neat style of attic windows in the front. Make two more in front and two more in rear.

If all the room should not be wanted at first, or if, for other reasons, the extra expense cannot be assumed, let the design be started with reference to this intention. The finishing may be left until the old bills for the house are all paid and something is in purse for the rest of the work. The house, finished as suggested, would be worth 33 per cent. more to sell, and 50 per cent. more to live in.

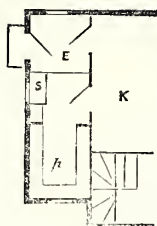


Fig. 55. Rearrangement of rooms.

This design is intended for a situation on the north side of a road running east and west; the house to stand end to the road, bringing the kitchen on the east and the living room to the south and east. A western view will be had from the bay window. If placed on the east side of a road running north and south, the entrance should be toward the road. The kitchen and living room would still retain their southern and eastern aspect. In that case the back entry and pantry should be changed as in the annexed cut.

Bill of materials and work.

	Feet.
Frame, 2 by 6 inches, 92 feet long	92
Sills, 6 by 8 inches, 120 feet long	480
Partitions, 2 by 6 inches, 1,200 feet long	1, 200
Plates, 2 by 6 inches, 106 feet long	106
Girts, $1\frac{1}{2}$ by 5 inches, 106 feet long	55
Floor timbers, (32 pieces,) 3 by 9 inches, 18 feet long	1, 296
Rafters, (15 pieces,) 3 by 6 inches, 13 feet long	292
Bearing beam, (1 piece,) 4 by 8 inches, 30 feet long	80
Roof boards	900
Flooring, surface measure	1, 000
Siding, surface measure	1, 400
Boards, for finishing	1, 000
Total	7, 900
Shingles	7, 500
Windows	9
Windows, bay	3
Doors	15
Nails, kegs	9
Plastering, yards	400
Brick, (8 by 4 by 2 inches)	1, 000
Carpenters' work, days	160
Masons' work, days	50

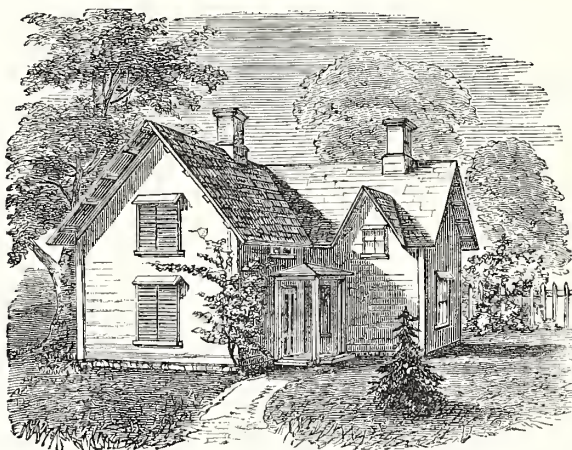


Fig. 56. Design for a Comfortable Cottage.

107. We have here one of the snugest, neatest, and most convenient of cottages. It does not stand upon the desolate road-side, a monument of ignorance and unthrift. A nicely graded lawn surrounds it. Trees are near to give their grateful shade and break the force of heavy winds. The rooms connect with each other in such a manner as to permit a draught of air to pass through from almost any direction when it is needed. It has closets and con-

veniences for the housewife in plenty. thence the kitchen or living room K, 12 by 14 feet. A window looks out on the porch. This, by the way, might be removed a few feet to the right and a door substituted in its stead. The living room is connected with the parlor P, a snug little apartment, 12 by 12 feet; also with the commodious bedroom B, the same size as the parlor. A chimney stands between the two. The bed-room has a clothes press c. On the other side of the chimney a door might be placed to connect the two rooms. But many people prefer to build their chimneys out of doors. On removing it to the end of the house we should be very likely to sacrifice the clothes presses. On this account, if no other, the chimney should stand where represented in the engraving. Outside chimneys cost more than those which are built under cover, because they take more brick and of a better quality.

From the porch G we enter the hall H;

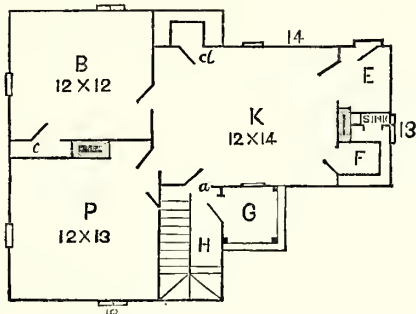


Fig. 57. Ground Plan.

The kitchen has an entry E, which may be used for doing the rougher work in. A sink connects with the entry. Here the men may wash and prepare for their meals. On the opposite side of the chimney is another closet F, serviceable for many uses.

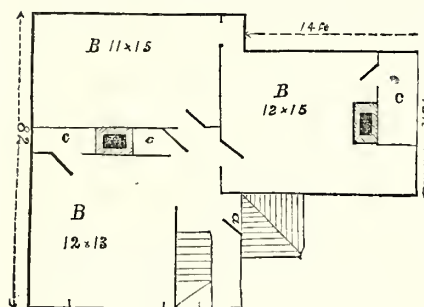


Fig. 58. Second story.

The arrangement of the rooms on the second floor is nearly the same as below. Each has its clothes press, and by a proper forethought each may have a fireplace for warming or ventilating. A small window at A, over the porch, will light the upper hall. It may be hung with hinges to open and let in the air.

Bill of materials and work.

	Feet.
Frame, 2 by 6 inches, 1,170 feet long.....	1, 170
Sills, 6 by 8 inches, 1,140 feet long.....	4, 540
Partitions, 3 by 4 inches, 1,200 feet long.....	1, 200
Plates, 3 by 6 inches, 120 feet long.....	180
Girders, 1½ by 5 inches, 120 feet long.....	62
Floor timbers, (24 pieces,) 3 by 9 inches, 13 feet long.....	700
Floor timbers, (40 pieces,) 3 by 9 inches, 20 feet long.....	1, 800
Roof boards.....	900
Flooring, (surface measure,) 1,200, (¼ added,) 300.....	1, 500
Siding, (surface measure,) 1,600, (¼ added,) 400.....	2, 000
Boards, for finishing.....	1, 500
Total.....	15, 552
Shingles.....	8, 000
Windows.....	11

Doors	4
Nails, kegs	10
Plastering, yards	510
Brick, (8 by 4 by 2 inches)	1, 500
Carpenters' work, days	160
Masons' work, days	60

108. The accompanying design is no fancy sketch. It is the home of a mechanic who by diligent attention to business and honest industry has achieved a compe-

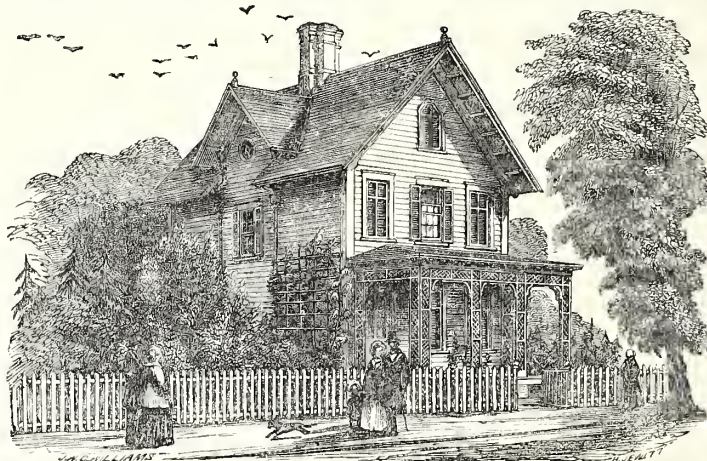


Fig. 59. A thriving mechanic's Home.* (Size, 30 by 20 feet; two stories with attic.)

tence. The house is approached by a veranda-porch. The principal floor is occupied by an airy parlor fitted up with recessed book-cases in the walls at the sides of the fireplace. In rear is a small living or dining room. Adjacent is the kitchen communicating with the back porch, in which is a sink. The chimney stack is placed in the centre of the building, the better to accommodate all the rooms with fireplaces and insure ventilation. In the summer the kitchen work may be performed in a back kitchen detached from the dwelling.

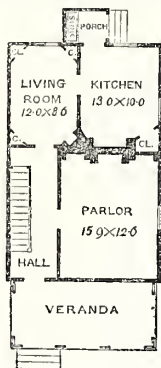


Fig. 60. Plan of principal floor.

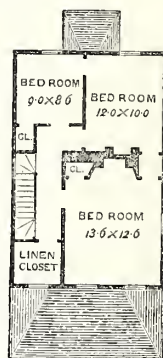


Fig. 61. Plan of chambers.

The arrangement of the chambers is plainly shown in the cut. Three bedrooms, a large linen closet, and two smaller clothes presses complete the accommodations for a family of moderate size to live in a very comfortable, genteel

* Figs. 59 to 71, inclusive, are from Vaux's Villas and Cottages.

way. A gable is introduced at the side to give headway for stairs to the attic should the wants of the family demand an occasional extra room or two.

109. In fitting up the parlor of such a cottage as this, remarks Mr. Vaux, the architect, good taste would indicate that the carpet should be of small pattern and quiet in color, so as to give an air of repose to the whole room. The wood-work might be either stained and varnished, or painted in light, cheerful tints. The walls should be covered with a pretty, fanciful paper, harmonizing with the wood-work, and not in large pattern, lest it appear to decrease the size of the apartment. The mantel-piece may be of wood, of some tasteful design, corresponding with the rest of the room, and yet look far better than a cold, costly white marble affair, that will run away with much money to no purpose. The centre table should be a serviceable, substantial piece of furniture, at which three or four people will be able to sit and read comfortably. A well-made chintz-colored lounge, although a much more economical and far more comfortable piece of furniture than a common rosewood sofa, will be found to have an equally agreeable effect in the room. Two or three tables of fanciful design and trifling expense, that can be moved wherever they may be wanted at a moment's notice, will give life and animation to such a parlor. An easy chair or two for tired visitors (besides the regular half dozen) will be found very acceptable. Some pretty, simple engravings on the wall in neat frames, and an oil painting or two, can be obtained at a very moderate cost. Pretty casts for the mantel-piece, or to be placed on brackets here and there on the walls, may be obtained for a mere trifle. A bird cage, a basin of gold fish, or a hanging basket of flowers, if there are any young girls in the family, will also help to give an air of vitality to the whole room, which should be the central point of attraction for all the inmates. It is possible, however, if we lay too much stress on these minor accessories, that some Mr. Blank may say: "This will never do. We can't have our girls fussing with flowers and birds and gold fish. They have their duties to perform and their studies to attend to." We will, therefore, stop here, venturing merely to remark, with all due deference, that although duties must, of course, be performed, yet innocent pleasures ought also to be encouraged, and that no study will insure so rich a reward to all concerned as the study of simple, quiet, domestic grace and elegance.

110. THE COLOR OF COTTAGES AND SCHOOL-HOUSES has much influence on their general effect. Every rural building, says the accomplished writer and architect just quoted, requires four tints to make it a pleasant object in the way of color. This variety costs but little more than a monotonous repetition, while it adds much to the completeness of the effect. They should be often cheerful and light, sometimes neutral, seldom dark, and never black or white. There is, fortunately, no end to the tints that may be used. The main walls should be of some agreeable shade or color; the roof trimmings, verandas, and other wood-work, being either of a different color or a different shade of the same color, so that a contrast, though not a harsh one, be established. The third color, though not widely different from the other wood-work, should be applied to the solid parts of the venetian blinds. The movable slats should be painted the fourth tint. This last should be far the darkest used on the premises, for the effect of a glass window or opening in a wall is always dark when seen from a distance. If this natural fact is not remembered, and the shutters are painted the same color as the rest of the house, a blank, uninteresting effect will be produced, for when the blinds are closed the house will appear to a person at a little distance to be without windows at all.

111. CONCRETE OR GRAVEL WALLS are of very ancient date in some parts of Europe. When well laid they are very enduring. They are better adapted to mild than cold climates. The French Huguenots introduced the art into this country. Some of the buildings which they erected remained habitable for a century and a half. Blocks of concrete, of which they formed forts along the

southern coast, are still in a good state of preservation. It is wise to secure the services of the most skilful workmen in undertaking any job with which you are not acquainted. This the builder of a concrete house should be.

The materials requisite are sharp, clean, sand and gravel, free from dirt, a portion of small stones and freshly burnt lime. The lime may be coarse; it must be strong. Oyster-shell lime answers well. But no lime that has been exposed to the air and become slaked is fit to use.

The foundation must be dry. If not naturally so, under-draining must be had. Where flat stones can be obtained it is well to lay a course in the bottom of the trench below the reach of frost. Where frost is not troublesome it is only necessary to go down to the compact solid earth for commencing the foundation. Hydraulic concrete is sometimes used to commence with until the walls are carried up a few feet.

There is not much difficulty in carrying up the sides. All the trouble will be at the corners. Hard-burnt brick or square blocks of stone may be used for these and at the openings for doors and windows.

There are two methods of constructing the walls. One is to form blocks of concrete in moulds; set them up to dry and harden, then lay them in the wall as you would blocks of stone. Another and more rapid way is to build a curbing on either side of the wall, lay the concrete in this and raise the curbing as the work progresses. The exercise of ordinary care will keep the walls plumb and true. The width of the moulds must be the same as the thickness of the wall. Each block may be a foot high and three feet long, or varied to suit the openings for doors and windows.

It is not advisable to give specific directions as to the quantities of the materials used. The mechanic, if he understands his business, will regulate that matter. With a proper admixture of sand, gravel, and small stones the amount of lime required will be just what is sufficient to form a perfect coating for every particle of sand, pebble, and stone. Any considerable excess weakens the work.

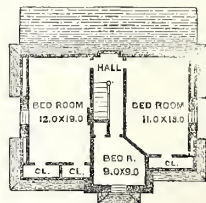
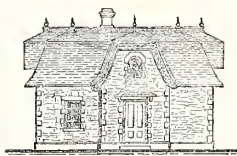
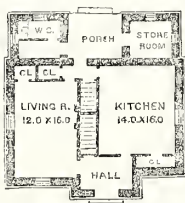


Fig. 63. Ground plan.

Fig. 62. Front elevation of Gardener's Cottage.

Fig. 64. Second story.

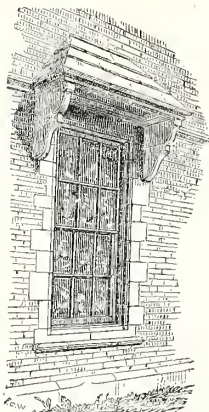


Fig. 65. Stone window hood.

112. This design for a gardener's cottage is intended for rubble work or stones as they come from the quarry, without dressing. It is also well adapted for gravel work. The engraving sufficiently explains the arrangement and use of the rooms. It will, perhaps, occur to the builder that a window on the right of the front hall in the ground plan might be preferred in some cases to the closet, since there is a liberal provision of them elsewhere.

The cut, Fig. 65, illustrates on an enlarged scale a style of stone hood for a window adapted to this class of work. When, after a year or two, the attentive hand has trained climbing vines to run upon the walls, this cottage will stand as one of the most winsome houses in the neighborhood.

113. Gables, verge boards, hoods, &c., of rural dwellings admit of an almost endless variety of designs. The elevation of the roof, its interruption by peaks,

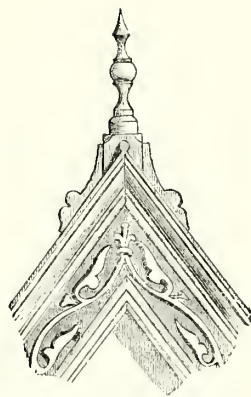
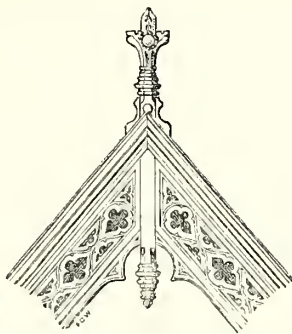
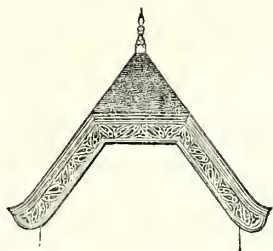


Fig. 66. Hipped gable.

Fig. 67. Verge board and finial, No. 1.

Fig. 68. Verge board and finial, No. 2.

dormers, &c., give character and expression, as the organs of the face affect the countenance of a man. The hipped gable is in common use on the more recent houses for the wealthy, and also for the occupancy of laborers in the neighborhood of our large cities. Its effect is entirely different from that of the ordinary plain gable, with its nicely wrought verge board. A neat verge board is an ornament; but too much of what is called filigree work is not in good taste. The designs are suggestive, and are subject to modification.

The high-peaked gable is still another desirable style where economy is less an object. The finials, or ornaments standing upon the peak in these designs, have also their own effect in modifying the general expression. The roofs of cottages last longer for being steep. Good heart pine or cypress shingles make the best covering for the roof.

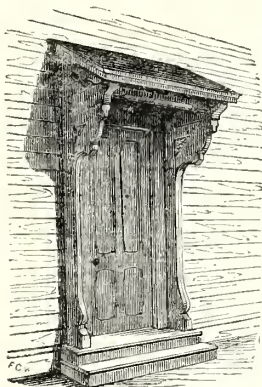


Fig. 69. Hooded door.

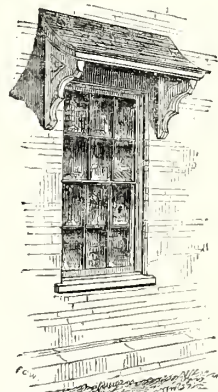


Fig. 70. Hooded window.

There is no beauty in a simple hood of itself as shown in either of the illustrations; but it is on such devices the architect relies in part to lift our cottages out of their close resemblance to stables or other outbuildings. The hooded door is coming into very general use. Indeed, it is an old style of ornamentation for plain houses, entirely in keeping with the humblest. It is now employed in some of the finest country residences on an enlarged scale. The hood, instead

of being but a foot or two wide, may be extended to three, five, or more feet, and, if you please, carried up in a peak with a roof jutting to each side. The timbers should be framed into the house, and supported at the outer ends by graceful brackets reaching down upon the side of the door posts. Underneath is the seat for the hour of rest and social chat. How inviting are such features. They seem to hold out the hand to the man of taste and bid him welcome. Set evergreens near them, train the ivy over them, and there let them stand to grace the humble entrance all the winter long. If you do these things your cottage will seem a palace, and never again be a bald, naked shelter only.

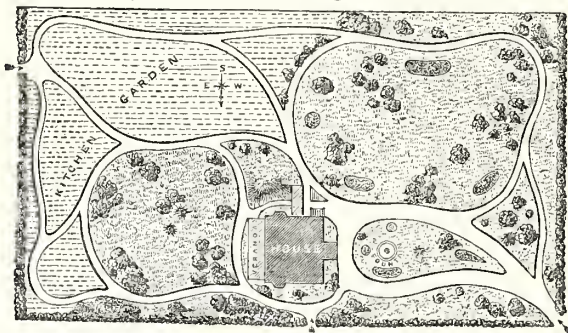


Fig. 71. Plan of grounds.—Designed by Vaux.

ing to the different parts of the grounds with a specific object to be gained in following them, is all that is required. In the plan above shown these intentions are most admirably executed. The house stands a little on one side of the centre at the front, perhaps on account of the gentle slope of the ground in every direction from that spot. At the right is a flower bed, and in rear of this are clumps of trees in the midst of a beautiful lawn. The kitchen garden occupies a liberal area near by, sloping to the south and east to receive the morning sun.

It is not expected that those for whom these hints are intended will be able at once to lay out their grounds on the costly and extensive scale which the plan calls for, but correct taste can better be formed by good models to guide the eye than by many elaborate directions. Having fixed on his plan, the owner may do what he can the first year, more the next, and so on until he has a very complete and tasteful arrangement of his grounds.

115. HEDGES—It is a troublesome thing for a poor man to be compelled to renew his fences every two years; and there is really no need of it. We would have him try a hedge. It will require several years to complete it; but when completed will last longer than the builder of it. But it takes forethought and perseverance. These two elements are the chief stock in trade for a poor man to invest in who wants to work his way up to competence. Without them the rich run down to the heels and vacate their mansions in favor of more industrious, prudent, thoughtful men.

An evergreen hedge is a perpetual delight. It forms a green wall in winter, and is no less beautiful in spring and at autumn. Arbor vitæ is the most common evergreen used. Why would not the holly grow well in long continuous lines, or several other varieties of evergreens? Young evergreens may be brought from the borders of the forest, not from its thick shade; these die on coming to the full blaze of the sun. Set them in double rows, six inches apart. Mulch and water them; trim them thoroughly if the roots are injured. Wrap straw around them to prevent them from drying up. After they get started they will need trimming into form.

In tropical climates not a few of the broad-leaved plants make magnificent

114. On a given lot the position of the dwelling is often determined by the nature of the ground, the view to be obtained, the shelter to be secured, or disagreeable and offensive objects to be avoided—as frog ponds, marshes, and the like. It is not desirable to have the plat cut up with numerous gravel walks into small divisions. A few walks lead-

hedges; but for common purposes, as for turning stock, some thorny plant is needed. The cheapest, and as yet the most reliable hedge plant, is the osage orange, a native of Texas. It is a rapid grower, and will make a hedge in four years. A single row of plants is set, plants one year from the seed, about four inches asunder in the row. After one year they are cut down close to the ground. Numerous shoots spring up from the stump. The second year these are cut down to six inches; the third year to one foot. After that they are let to grow up to four or six feet, according to the object to be gained. One hint is never to be forgotten in this branch of work. Keep the hedge broad next the ground. If you fail in this at the start, hoping to get a fence sooner by letting the plants run up, the error is fatal; no amount of tinkering will mend the defect. If kept trimmed closely at the top the base naturally broadens. Then let the upper branches come on and take their place, but never to extend out so far as the lower ones. Plants must have light. Leaves will not grow in the dense shade of a hedge. Large trees along the line of a hedge injure their symmetry of growth. Damp grounds are bad. The osage will not flourish in either situation; shade or "damp feet" kill it. The breadth of a hedge at its base should be four to five feet. It may taper at the top to 12 or 18 inches.

While the plants are young they require cultivation to keep down the weeds. If the climate be hot and arid, it will be necessary to mulch them; that is, to cover the row on either side with a coat of straw or saw-dust to prevent moisture from evaporating, and thus drying up the young roots. After the plants have become well established the roots run down deep into the ground. The branches will give a shade, and they will sustain themselves as well as other trees. The time may come when our broad acres will be too closely hemmed in by dense population to give so much space as hedges require; but that is a question for generations to come, about which we need borrow no trouble.

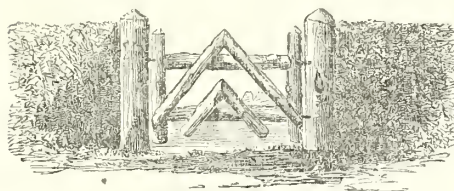


Fig. 72. Rustic Gate, No. 1.

of a little resolution to be men among men.

To make them, select cedar poles for the materials. Trim off the small branches without interfering with the bark on the parts to be used. The poles need not be over three to five inches in diameter. Mortise the uprights and tenon the rails; fit the cross-pieces to their places by halving out the points of intersection with the rails, so they will lie closely. Bolt all the joints firmly. Countersink for the nuts and heads. The upper end of the posts or uprights should be shaved or rounded and painted with shellac to shed the rain and prevent the heat from checking them.

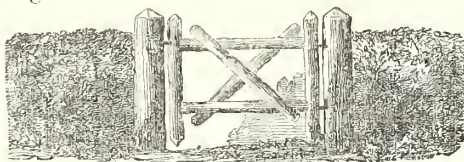


Fig. 73. Rustic Gate, No. 2.

There are a dozen different forms for these gates. In all the idea is prominent that the cross-pieces must serve as braces to keep the gate from sagging.

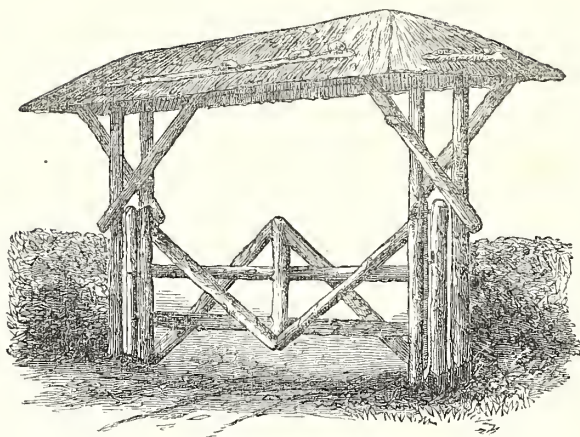


Fig. 74. Hooded Rustic Gate.

This novel and pretty design may be easily constructed by any man who is handy with tools. The cut represents one for wagons. It is quite as unique on a smaller scale for the front gate leading to the house, and of course would not be quite so formidable an affair to attempt to construct. There are two high posts at each end, planted about two feet asunder. A cross-piece is fastened to the top of these. It is supported at each end by the braces bolted on to the posts.

Plates, if they may be so designated, rest on the cross-pieces. This is the foundation for the roof. It may be made of narrow boards or smaller cedar poles laid close together or thatched. The thatch will be laid on and secured in the usual manner. Shorter posts may be set between the tall uprights for the gate, so that it will hang in the centre. They may be fastened to them so that they will not move from their places by the weight of the gate. Gates of this style, well made and firmly bolted, will last many years without repairs.

117. Rustic work is adapted to many useful and beautiful devices around the home. It may constitute the frame-work of a porch, which an ingenious laborer can build with his own hands, large enough for the comfort of all his family. A screen or a trellis, the well-curb, an arbor, or a shaded seat may be constructed of boughs with bark on, naturally arched in the desired forms. Quite a variety of wood is fitted for this work. Besides red cedar, the white ash, after it has grown rough-barked, is very excellent and long lasting. The sassafras at a dozen years old matures into roughness of bark, and the bark sticks tightly to the wood, and the wood lasts long exposed to the weather. Slow growing trees hold their bark best. They should be cut late in the fall, when they have got ready to stand a long contest with winter. The bark hugs closest to them then. The bark of the oak and pine soon cleaves off and leaves the sap-wood bare. Those varieties of wood produce the best effect which have the habit of cracking the bark finely with age. Precautions are necessary to keep out insects from working in the sap-wood. A coat of petroleum will do that, and an application or two, annually, of shellac varnish (gum shellac dissolved in alcohol) will form a covering which will resist the attacks of the rain and prevent the exposed ends of the sticks from cracking, as before stated. Such simple decorations are neither meaningless nor expensive. To an intelligent observer they are very expressive. They speak of culture and refinement within, a fondness for something more than the barest supply of our animal wants, yet none the less regard do they indicate for life's common affairs. The man of taste does not look for cultivation in a hovel nor for refinement in a barrack. Even the "child of penury by instinct shuns the poor." The yard, the gate, the walk, and the grounds, as well as the house, all tell him something of the kind of people he may expect to find within. The culture of refined sentiments and the daily practice of the amenities of life lead to higher conceptions of its aims and possibilities, while to live like brutes makes brutes of men.

Useful hints applicable to cottages and those who live in them are contained in the former portion of this work, especially the articles on ventilation, warming, and lighting.

To be happy, the poor man and woman, as well as the wealthy, must have an honorable object in view, to accomplish which they press onward with a hearty good will. Active occupation through the day sharpens the appetite and composes the body for rest at night. It turns the thoughts away from griefs that corrode. It keeps the system in health and preserves the mind in peace. Add to industry economy, and to economy purity of life—that family will prosper which possesses these. Respect, esteem, honor, and competence will surely be theirs.











